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PRACTICAL ESSAYS

ON

AGRICULTURE:

CONTAINING

An Account of Soils, and the Manner of correcting them.

An Account of the Culture of all Field Plants, including the Artificial Grasses, according to the Old and New Modes of Husbandry, with every Improvement down to the present Period.

Also, An Account of the Culture and Management of Grass-Lands; together with Observations on Enclosures, Fences, Farms, and Farm-Houses, &c.

Carefully collected and digested from the most eminent Authors, with Experimental Remarks,

By JAMES ADAM, Esq.

VOL. I.

Majores noſtri, virum bonum cum laudabant, ita laudabant, bonum agricolam, bonumque colonum; ampliſſime laudari exiſtimabatur, qui ita laudabatur. Cato, *De Re Ruſtica*, Lib. I.

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PREFACE.

HAVING been led by an early inclination to the ſtudy of Agriculture, I often indulged that predilection as the *laborum dulce lenimen*, during my attention to other inquiries, and even amidſt the hurry of profeſſional purſuits.

The long continuance and vaſt expence of the American war, by checking the national ardour for the fine arts, procured me opportunities of attending to that favorite object, which particularly gratified a natural propenſity. My reſearches into the moſt eminent authors on this ſubject, with ſelect paſſages extracted from thoſe authors; my own experiments carefully noted down, and daily increaſing; ſoon formed a work of no inconſiderable magnitude. This it was, which firſt ſuggeſted to me the idea, of digeſting and correcting the whole, and of reducing it into ſuch a form and arrangement, as might, perhaps, render it a work of ſome utility to the country gentleman, and to the farmer.

To thoſe authors whom I have chiefly conſulted in the courſe of this work, I owe great obligations, for the knowledge and information I have derived from their labours: but it would be extreme want of candour, not to acknowledge in a particular manner, how much I feel myſelf indebted for aſſiſtance, to a moſt elaborate work of my ingenious and much eſteemed friend, JOHN MILLS, Eſq. entitled, A NEW AND COMPLETE SYSTEM OF PRACTICAL HUSBANDRY, publiſhed in the year 1762, and now out of print.

This valuable collection of knowledge, extracted from the beſt authors, contributed greatly to circumſcribe my reſearches, and to ſhorten my labours. But, ſingular as it may appear, yet I will venture to aſſert, that during the very ſhort interval from that publication to the preſent time, Agriculture has undergone an almoſt total change in this country; not only by the rapid progreſs made in the real knowledge of the art, but alſo by the invention of new implements, and new methods of performing the work. This we owe, partly, to the information diffuſed, and ſpirit of inquiry excited, by the above-mentioned work; partly, to the vigorous exertions of country gentlemen; and partly, to the moſt laudable and patriotic zeal and attention of the ſeveral Agricultural Societies, eſtabliſhed in various parts of theſe kingdoms; particularly, to thoſe of London, Edinburgh, Dublin, and Bath, whoſe ſtores of uſeful and experimental knowledge have been communicated to the world in their publications; from whence I have drawn ample ſupplies of authentic information.

If there be any peculiar merit in this work, it chiefly conſiſts in having endeavoured to extract the ſubſtance from crude and voluminous materials; in having attempted to methodize what ſeemed ill arranged; to abridge, what ſeemed prolix; to decide, what ſeemed looſe and undetermined; to correct errors; and to ſubſtitute practical knowledge for theoretical diſſertation.

If it ſhould be ſuggeſted, that I am blameable, for not having quoted my authorities, with more ſcrupulous preciſion; I will only ſay in my own vindication, that when I have been guilty of ſuch omiſſions, it certainly did not proceed from any deſire of arrogating to myſelf the merit due to others, but to prevent the inconvenience of too frequent interruptions of the narrative, which often prove not only tedious, but irkſome. Theſe omiſſions will never ſurely be imputed to improper feelings of vanity, when I ſay, that I by no means pretend to have produced a work of invention or genius, but one merely of obſervation and of compilation.

I ſhall only add, that my great aim has been to make this book conciſely uſeful; deſirous as I am that every gentleman and farmer may there find, without the trouble of much reading, the information he requires to enable him to accompliſh his purpoſe, in the beſt, cheapeſt, and moſt approved method.

At the ſame time, I ſhall feel much ſatisfaction, ſhould this work, the reſult of conſiderable attention and care, be productive of any advantage to the public; and particularly, ſhould it tend to promote, in ſome degree, the ſpirit of Agriculture, that ſolid and permanent foundation of national proſperity!

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ERRATA IN VOL. I.

Page 146, line 15, *for* All *read* Many.
252, A. *for* funnel *read* funnels.
255, 20, *dele* The prevents.
273, 2, *dele* Pulſe.
319, 15 and 26, *for* Anderſon *read* Anderdon.
319, 23, *for* having *read* leaving.
320, 24, *for* Anderſon *read* Anderdon.
338, 6, *after* pulſe *add* or roots.
339, 10, *for* Boote's *read* Cooke's.
359, 3, *for* for *read* or.
365, 23, *for* ſeaſon *read* ſeaſons.
396, *note*, line 2, *for* dowy *read* down.

Directions for placing the PLATES.

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Plates I. and II. to face page 204.
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PRACTICAL ESSAYS

ON

AGRICULTURE.

ESSAY I.

Of AGRICULTURE.

AGRICULTURE is the art of aſſiſting the earth, by means of culture, to bring forth plants in greater quantity, of larger ſize, and of better quality, than it would produce without that aid.

It is an art of ſuch conſequence to mankind, that their very exiſtence, eſpecially in a ſtate of ſociety, depends upon it. A conciſe account, therefore, of every material diſcovery that has been made in this art, muſt be uſeful both to the farmer, and the philoſopher. To accompliſh this deſireable end, and at the ſame time point out the path to further improvement, are the objects of the preſent work, which I have endeavoured to bring within as narrow bounds, as the nature of my ſubject would allow.

The principles of Agriculture are ſo few, and ſo ſimple, that, at firſt glance, we ſhould be apt to imagine this art was extremely limited, and would require little explanation. But upon a more intimate inveſtigation of this intereſting ſubject, we ſhall ſoon find that it branches into infinite detail, and comprehends large fields of philoſophical inquiry.

Before I proceed to the conſideration of thoſe objects, it is requiſite that I ſhould enumerate the few principles upon which this art is founded. They are as follow:

To make land dry by draining,
To make it clean by weeding,
To make it friable by ploughing,
To make it fertile by manuring.

Theſe are leading principles, of which we muſt never loſe ſight, in all our operations; but muſt have recourſe to them on all occaſions, as the great baſis of our ſuperſtructure.

But ere I proceed to deſcribe the culture and management of land, it is proper firſt to examine what is the nature of ſoils; for of theſe there is great variety, which, however, with ſome leſs eſſential differences, may, I think, be comprehended under the following general deſcriptions.

Of SOILS, viz.

Black Mould, Clays, Sand and Gravel, Loams, Chalk, and Motherſtone, and, laſtly, Uncultivated Lands; which, with their ſub-diviſions and various combinations, include all the qualities of thoſe ſuperficial ſtrata of earth, ſo well known by the general names of ſoil, or ſtaple*.

Theſe ſoils, or ſtaples, are of various depths; and under them lie other ſtrata, often of very different qualities. A conſiderable depth of ſoil is of great advantage to any land, whatever uſe it may be put to; becauſe plants can there puſh their fibrous roots to a greater depth, in ſearch of food; and it alſo admits of having a ſupply of freſh mould plowed up from time to time. It is not, therefore, the ſuperficial ſoil only, which the farmer ought to conſider, but the depth of it, and what lies immediately underneath. For if the richeſt ſoil is only ſix or ſeven inches deep, and lies on a cold wet clay, or hungry gravel, or chalk, or motherſtone, it will not be ſo fruitful as leaner ſoils that lie on a better under-ſtratum, of which a dry, firm, and ſandy gravel is, perhaps, the beſt. But it muſt at the ſame time be obſerved, that moſt of the grains and pulſe commonly cultivated, do not require a ſtaple of more than twelve or fourteen inches deep, to bring them to great perfection; but moſt roots require more.

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* I am aware that, philoſophically ſpeaking, various proportions of clay, ſand, and water, form nearly what is called earth, or ſoils. But as I write for farmers, I ſhall conſider ſoils as connected with all their extraneous matters.

SECTION I.

Of Black Moulds.

BLACK Mould, which is formed by the repeated rotting of leaves, or other vegetable, or animal ſubſtances, is certainly the beſt of all ſoils. It is fat; and though porous and light, is yet ſufficiently tenacious. It riſes in pretty large pieces, of its own accord, but after a ſhort expoſure to the air, it crumbles, though not altogether into duſt, which is the defect of a leſs perfect ſort. This excellent ſoil is fit for almoſt any thing, without much manure. The farmer is not often ſo happy as to meet with it; or, if there be a ſmall depth of it, other leſs fertile ſoils lie frequently underneath.

SECTION II.

Of Clays, or ſtrong Soils.

CLAYS are of very different ſorts, and as different colours. The blue, pyritous; the white, ſandy or calcareous; the red and yellow clays, ferruginous; if ſtrong, are all unkind. But of theſe the white is leaſt ſo; becauſe thoſe matters from whence it derives its colour, ſo far as they go, tend to correct it. The gravelly, or looſe ſort is ſometimes very tolerable; and the leſs tenacious it becomes by approaching towards the loam, or brick earth, the more fertile it is found to be, and the better ſuited to vegetation. Stiff or ſtrong clays, however unfavorable, are not incorrigible; and I may perhaps venture to aſſert, that there is ſcarcely any ſoil ſo barren, or untoward, but may be made to yield to the ſkill, and induſtry of the perſevering huſbandman.

As clay is unctuous, and tenacious, it retains the water it receives, as in a diſh. This ſtagnates and ſours, chilling the plants, and preventing vegetation*. Beſides, in dry ſeaſons it hardens with the ſun and wind, and the cloſeneſs and ſtiffneſs of its texture hinders plants from extending their roots in ſearch of food, and prevents the entrance of moiſture, which would help to convey it to them†.

Amongſt all the corrective manures for clay, ſea-ſand claims a preference, founded on experience, as beſt ſuited to break its too great coheſion. River-ſand, drift-ſand, ſmall gritty gravel, the ſcouring of high roads, lime, chalk, marle, rubbiſh of old houſes, coal-aſhes, and in general all calcareous ſubſtances, are of excellent ſervice to anſwer the ſame end‡.

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* In too moiſt ſoils, ſays the learned, and very ingenious Dr. George Fordyce, the water ſoaks through to the tubes of the roots, ſtops the circulation in them, and rots them. A moderate heat prevents moiſture from having ſuch fatal effects.—Elements of Agriculture, p. 74 and 84.

† If the reſiſtance from the tenacity of the ſoil be too great, the roots break out into a vaſt number of branches, too weak to ſupport the plant. Idem, p. 79.

‡ The ſubſtances which burn into lime, and with which acids effervefce, or riſe into numerous ſmall bubbles, are called calcareous bodies. They are ſaid to abſorb the acid, becauſe, when mixed with acid or ſour liquors, they attract or ſuck up the acid, and leave the liquors mild and ſweet. Such are marble, limeſtone, chalk, marle, ſhells, coral, &c.

Doctor Cox's account of ſea-ſand uſed in the agriculture of Cornwal, deſerves particular attention; as the means by which huſbandmen in other parts, if their lands be near the ſea, may often reap great advantage, which many are ignorant of, or overlook*.

Quantities of this ſhelly ſand lie neglected on large tracts of the coaſt of Great-Britain. The benefits ariſing from it, particularly when laid on clayey grounds, are indeed ſlow; but they are very laſting. The improvement is not ſo conſpicuous the firſt or ſecond year, becauſe the corrective manure conſiſts of hard bodies, ſuch as ſhells, fragments of coral, and other calcareous ſubſtances, which require time to ſcale and pulverize; and this continues to be an annual proceſs for a long ſucceſſion of years. The beſt is that which is moſt mixed with coral, and other marine plants. It gives the ferment of lime, and the fatneſs of oil, to the land it is laid on. Being more ſolid than ſhells, it conveys a greater quantity of fertilizing matter in an equal bulk; nor does it diſſolve in the ground ſo ſoon; but, decaying more gradually, continues longer to impart its warmth to the juices of the earth.

The quantity they are ſaid to lay over an acre

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[*] Philoſophical Tranſactions, No. CXIII.

of land in Cornwal, is prodigious; being no leſs than four thouſand five hundred ſacks or horſe loads, or twenty-eight ſacks per pole; but I ſuppoſe this is the very utmoſt, on lands adjoining to the ſhore, and that it is uſed much more ſparingly at a diſtance. Where it is uſed more ſparingly, I am perſuaded it muſt have better effects; for the conſequence of ſo ſuperabundant a dreſſing is, that the ſtraw is very ſhort, with much grain: indeed on land thus dreſſed, it has been known to produce ears of barley as long as the ſtraw they grew upon.

Though barley-ſtraw is extremely uſeful to the huſbandman, yet this deficiency may be compenſated by the fulneſs of the crop; but then it is to be obſerved, that land thus dreſſed has this greater inconvenience, that in ſix or ſeven years it becomes ſo tender, and mellow, that the corn which grows upon it cannot ſupport itſelf, and the land muſt be ſuffered to lie untilled for a year or two, that the ferment may be quieted, and the ſoil grow firmer and more tenacious; after which, it will again bear as before, and continue ſo to do, with like intermiſſions, for twenty, or thirty years. This extreme ferment is, no doubt, created by overdoing the quantity of ſand; and ought to be prevented by uſing it more moderately.

There is a ſimilar practice in Ireland, in that part of the bay of Londonderry, called Lough-foil, towards the eaſtern ſhore of which lie ſeveral eminences, which are formed of ſhells. From theſe the country people carry off boat-loads, which they depoſit on the ſhore till they drain, and become lighter for further carriage. They allow from forty to eighty barrels to an acre. Theſe ſhells agree with boggy, heathy, clayey, wet, or ſtiff land, and give it a ferment, as yeaſt does to bread, opening and looſening the clods, and by theſe means making way for the roots to penetrate, and for the moiſture to nouriſh their fibres.

The good, and laſting effects of ſhelly ſand, for the improvement of clay, afford a plain proof that there is an acid in the clay, which theſe ſhells abſorb and correct*. For when that acid is removed, the clay becomes more eaſily ſoluble in water; or, as farmers term it, it is rendered mellow. The ingenious Dr. Home ſeems to be of opinion, that clays contain no acid; but if it be admitted that they are pyritous, and aluminous, which chemiſts contend they are, they muſt, in that caſe, undoubtedly, be allowed to contain ſome portion of the vitriolic acid*.

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* Dr. George Fordyce obſerves, that where there are any metallic, or aluminous ſalts, as theſe are poiſonous to plants, they ought to be decompoſed by quick lime. Elem. of Agriculture, p. 100.

The tenacity of clay does not ſeem to be altogether owing to the ſmallneſs, and unctuous ſmoothneſs of its particles; for in this ſome marles much exceed it, and yet are perfectly ſoluble in water, which proceeds from the mixture of calcareous earth; and if clay is rendered, in ſome meaſure, calcareous, by the mixture of alkaline, or calcareous ſubſtances, ſo long as it is in that ſtate, it is ſaid to be mellow; that is, it continues fit for the production of plants, till the alkali is neutralized by the acids in the earth or air, or the calcareous earth ſo impregnated, that they become ſaturated, and can no longer abſorb the acids of the clays, or ſoils, with which they are mixed.

If this be the fact, which I think is moſt probable, and is indeed ſanctioned by experience, it muſt greatly diminiſh our ideas of the value of common ſand, uſed for the ſame purpoſe. We muſt of courſe allow, that whatever additional fertility it gives to clay, can only proceed from its powers of ſeparating and rendering it leſs tenacious, and binding. This it certainly does; and its good effects have been aſcertained by the moſt reſpectable authorities, both ancient and modern.

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* Macquer's *Dictionnaire de Chimie*, Article *Argile.*

To this I too can ſafely bear teſtimony from experience, the ſureſt of all guides; for, by a very plentiful dreſſing of ſandy loam, I greatly amended a field of ſtrong clay.

Small gritty gravel operates in nearly the ſame way, and is better for being ſkreened, to prevent a mixture of ſtones; but where that expence cannot be afforded, even ſmall ſtones may be allowed to paſs, without much injury. Good crops have been produced by very ſtiff and ſour land, after it has been corrected with gravel.

Shell marle, or any marle which makes a ſtrong effervеſcence with acids, is a ſingularly good corrective manure for clay; becauſe, diſſolving eaſily in water, it gives a ſufficiently free paſſage to this fluid; by which means the clay is kept dryer even in winter, and looſer and opener in ſummer: and if the ſoil be of a cold ſour nature, the abſorbent quality of the marle deſtroys that mineral acid, and creates the warm fermentation before mentioned.

The foſſil ſhells which have been found in ſome countries at a great diſtance from the ſea, are a good manure, if they ſtill retain their quality of ſhells: but beſides their being generally petrified, they never are ſo ſerviceable as thoſe which are taken from the ſea-ſhore.

All animal and vegetable ſubſtances are likewiſe proper manures for clay: but as I rank them as general manures, and not as correctives for clay only, I ſhall notice them more particularly hereafter.

The alkaline quality of the aſhes of all vegetables*, and the calcareous quality of coal aſhes, render them ſingularly beneficial to ſtiff and ſour land: for which purpoſe they are ſucceſsfully employed in the neighbourhood of great cities, where coal is uſed for fuel. They open clayey grounds, and correct their bad qualities: they make a warm dreſſing for meadow lands, killing the moſs, and improving the ſwerd. The gardeners, and farmers about London know their value, and make a profitable uſe of them. Bradley blames the people of Staffordſhire, and the adjoining counties, for not improving their heavy grounds around their coal-pits, by manuring them with coal aſhes, which might be made from the waſte coals. On the ſame principle, we are to account for the effects of calcined earth, commonly called Burn-baking, or Devonſhiring, which will be treated of under the head of uncultivated land.

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* It is well known that the aſhes of all vegetables, burnt when full of ſap, produce a ſtrong fixed alkaline ſalt: hence pot and pearl aſhes. This ſalt powerfully attracts water, and ſtill more ſtrongly attracts acids, till, ſaturated with them, it becomes a neutral ſalt.

Vegetables, when full of ſap, being thrown into a heap, will heat and ferment, till the whole maſs becomes a pappy, or ſaponaceous ſubſtance. Hot lime accelerates the fermentation, and reduces the maſs ſooner into this ſaponaceous ſtate: in which ſtate it will be found an excellent manure, or an admirable ingredient in any ſtercoraceous compoſt.

The generality of Authors who have written on Agriculture, have been ſo little acquainted with the nature of lime, that their ideas about the manner of uſing it, and its effects upon different ſoils, have been altogether contradictory. This does not ſeem to me the proper place for entering upon this ſubject; never having conſidered lime as a corrective for clay land only. I ſhall therefore reſerve what I have to ſay upon it, till I come to treat of manures in general.

I cannot, however, omit to mention chalk here, as one of the greateſt, and moſt convenient of all the correctives of clay. In this county (Herts) it is the grand reſource, to which we apply in all difficult, and obſtinate caſes; and indeed it abounds ſo univerſally in all the ſouthern parts of England, that it may be reckoned one of the greateſt promoters of the fertility of this iſland. But of this I ſhall have occaſion to ſpeak more fully hereafter.

Beſides the correctives already mentioned, there is one more, which is to be had every where; I mean, the clay itſelf, which, when burnt in heaps, makes an admirable ſeparative, or rectifier, of ſtiff lands. Every one knows, that clay burns into a very hard ſubſtance; this, mixed with the clayey land, divides its coheſive particles, and makes it looſer and more free. Its having been calcined, alſo helps to remove, in ſome meaſure, the coldneſs, and to abſorb the acidities, of the clay: all which are means of great improvement. Of this I have had ample experience; and have found that this uſeful aid could be procured at the moderate expence of two pence per buſhel, ſpread on the land.

Many other articles might be mentioned as correctives to a clayey ſoil: but theſe are perhaps local, and not general improvers; and therefore would be leſs uſeful in our catalogue. I muſt not, however, omit to mention the drift, or ſoil, collected from the highways, and generally to be procured for the expence of carriage only. This, to farms lying contiguous, is an admirable reſource; for it not only acts as a corrective of ſtiff ſoils, but is often charged with the dung and ſtale of cattle, which give it a very great degree of fertility: of this I alſo ſpeak from experience; for I have fully proved its good effects. To theſe let me add, the great advantages derived from the uſe of bones, and of Tanners' bark, heath land, and dried turf, or peat; all of which are excellent

lent, when they can be obtained at moderate expence. But allowing all theſe methods of improvement their due degrees of merit, I cannot conclude this ſection without obſerving, with Mr. Evelyn, that, "Amongſt the mechanical aids "wherein ſtercoration has no hand, that of pulve"rizing the earth by contuſion, and breaking it "with the plough or ſpade, is of moſt admirable "effect." For, turning up the land to the operation of the winter's froſt, and ſummer's ſun, not only renders it mellow, and mouldy, but it is alſo much ſweetened and enriched by the influence of the air. What it imbibes from thence, is, I believe, as yet a myſtery to mankind; but, that it does imbibe a fertilizing quality, is proved beyond a doubt, both from the effects of ſummer fallows, and alſo from the large quantity of ſaline matter with which nitrous compoſts are impregnated by turning inceſſantly, and expoſing them to the influence of the air. Labour, and aſſiduity are, therefore, principal ingredients in forming our correctives for clay ſoils; and though theſe ſoils require much care and expence to improve, yet, when ſo improved, they enjoy ſome advantages over lighter ſoils, retaining in drought the moiſture ſo neceſſary for the produce of large crops, and repaying by their ſtrength, and fertility the extra expence of their culture. All farmers know that

Wheat, Beans, Cabbages, Tares, Rye-Graſs, and Oats, are the profitable produce of theſe ſoils.

SECTION III.

Of Light Soils, and the Manner of improving them.

SANDY, gravelly, and other very light ſoils, eaſily admit of heat, and moiſture, but are not much benefited thereby, becauſe they do not retain them, ſo as to produce any degree of that firmneſs, and tenacity ſo neceſſary to form a ſoil proper for vegetation; that is, for the growth and nouriſhment of plants.

The conſequence of this is, that any crops produced by ſuch ſoils are thin, and feeble; and though they are more early, from the roots being able to puſh their tender fibres rapidly through ſo friable a texture, yet the ſtraw, or haulm of theſe plants is extremely ſhort, and unſucculent*.

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* If, ſays Dr. Fordyce, the ſoil has too little tenacity, the roots run out into long fibres, having too few ends or mouths to abſorb ſufficient nouriſhment. Elem. of Agric. p. 79.

At the ſame time it muſt be obſerved, that if ſuch ſoils are favoured by dropping ſeaſons, the fruits and ſeeds which they bear are not only ſooner, but better ripened, and fitter to keep, than thoſe that are produced by ſtronger lands; becauſe the moiſture of light ſoils being ſooneſt exhaled by the ſun, their productions are the leaſt ſucculent, and contain the feweſt watery particles. For it is a maxim in huſbandry, founded on experience, that too great richneſs of land often occaſions too much luxuriance in plants, which is an enemy to the bearing of firm, ripe, and abundant grain.

On ſuch land, moſt manures are of little ſervice. They are ſometimes ſo hungry and ſo voracious, that they devour, and paſs away with rapidity, whatever is laid upon them. But if the looſe, and lean ſand, or gravel underneath, happens to have a ſurface, or ſtratum, of good mould over it, though it does not long retain moiſture, it may bring a forward ſweet graſs; which, though ſubject to burn in long drought, yet quickly recovers with the leaſt rain.

To bring theſe light open ſoils to a due conſiſtence, to correct their defects, and change them to a middle ſtate, between ſand, and clay, or, in other words, to reduce them as much as poſſible into a loamy ſtate; ſome of the ſtiffer earths muſt be uſed, in proportion to the degree of lightneſs in the ſoil they are meant to rectify.

By the ſame rule, that ſand fertilizes ſtrong clayey grounds, clay meliorates light and ſandy ſoils. But that this manure may have its due effect, it muſt be divided into ſmall particles, ſo as to enable it to incorporate with the light earth. For this reaſon, clay becomes a much better manure, when mixed with chalk or with lime, or a calcareous marle, than either of them would be ſeparately: for theſe correct the bad qualities of the clay, abſorb its acidities, and render it friable*.

The farmers in the North-Riding of Yorkſhire dry their clay about Midſummer, on the declivity of a hill, and lay an hundred loads on an acre of light ſandy ground. They obſerve, that it continues in clods upon the land for three or four years, and that it bears rank, ill-coloured, and broad-grained barley, the firſt year, but afterwards a plump round corn, like wheat. The good effects of this clay manure for ſandy ſoils have been experienced to laſt upwards of forty years.

It is almoſt needleſs to obſerve, that this excellent manure for ſandy, gravelly, and other light ſoils, can only be uſeful upon lands of a nature entirely different from its own. To theſe it gives coheſion or tenacity, the quality they ſtand in need of; by which means they are changed from what they originally were, to an equal fertility with the beſt and richeſt*.

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* Leſs clay, ſays Dr. Fordyce, will be uſeful in ſandy ſoils, than ſand in clay ſoils. Ibid, p. 89.

It has already been obſerved, that dung is not the moſt uſeful manure upon ſuch light land; it is ſuddenly waſhed downward: but were it to remain in the ſtaple, it would ſerve to give it proper texture and mucilage, which are preciſely the correctives required†.

The Author of the New Syſtem of Huſbandry relates, p. 124, that a friend of his had two fields adjoining: one was a hard brown clay, the other a very burning gravel. He was ſurpriſed to find theſe diametrical oppoſites ſuch near neighbours, and reſolved to attempt the cure of both. He therefore pulled down the hedge that divided them, trenched both fields, and carried the clay and gravel interchangeably, mixing the clay with the gravel, and the gravel with the clay: then plowing the whole with a deep-cutting plough, he ſowed it with the richeſt grains for ſeveral years, and had not a finer or more mellow piece of land on his eſtate: the whole was converted into a good hazel mould, which produced a plump round corn, and plentiful crops. Another inſtance of the ſame kind is given by Mr. Bradley*. An acquaintance of his had a large piece of heathy or ling ground, and another which lay contiguous was a ſtrong clay. They were both deemed barren lands: he however adviſed to manure one with the other, which was done; they were then plowed and ſowed with barley, and yielded an extraordinary crop. The piece of clay land had clover ſown with the barley, was fed part of the winter, and brought two exceeding fine crops of clover the next ſummer. The other bore as fine wheat as any in the county.

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* In Norfolk, where they have made amazing improvements by clay and marle laid on their ſandy grounds, they remark, that on a pure ſand, clay is the greateſt improver; but on a loamy ſand, marle anſwers beſt.

† Any defect of texture, ſays Dr. Fordyce, may be made up by mucilage. Elements of Vegetation, *ubi ſupra.*

Theſe, and ſome other manures of a more general nature, are ſerviceable to ſandy ſoils; but none is equal to marle, of which there are properly but four kinds, viz. the ſtone, the clay, the calcareous, and the ſhell marles. They attract and ferment with acids, and do not bake in the fire like potter's earth; which ſufficiently diſtinguiſhes them from clay. Upon being expoſed ſome time to the weather, they ſlack and fall to powder like quick lime. When dry, they are friable and unctuous; when wet, they are ſoft and ſlippery to the touch. The ſtone, clay, and calcareous marles, are nearly of the ſame nature; the ſhell differs from all. Though plants will not grow in them when pure, yet, when mixed with ſoil, they become an excellent manure. They partake greatly of the quality of lime, and act nearly in the ſame manner on the ſoil. They communicate to it the power of attracting vegetable food from the air, and diſpoſe it for the nouriſhment of plants. They likewiſe attract oils ſo ſtrongly, that they are frequently uſed for extracting greaſy ſpots out of cloth. They are therefore ſuppoſed to attract mucilaginous oils from the earth and air, which they diſſolve, and prepare for entering the roots of plants.

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* Complete Body of Huſbandry, p. 61.

Both ſtone and clay marles are long of ſlacking and falling into powder. Large pieces of the former are ſometimes found many years after it has been laid on. This makes it neceſſary to employ a greater quantity, leſt their effects ſhould not at firſt be felt. As marle may be uſed with ſafety in greater quantity than lime, it may communicate to the ſoil a ſtronger power of attracting the vegetable food, and ſhould therefore be preferred. Stone and clay marles are alſo preſerable to lime in this reſpect, that, being longer of diſſolving, their effects continue longer to be felt. However, if the ſoil be looſe and ſpungy, the marle, like lime, will ſink beneath the reach of the plough, and thereby prevent thoſe advantages which might naturally be expected from it. But as both theſe and calcareous marles are forcers of the ſoil, as well as lime, the marle muſt not be repeated, without giving it ample ſupplies of mucilaginous matter to act upon, ſuch as dung, or other animal or vegetable food.

The calcareous marle is a white, pure ſubſtance, like chalk, but fat and unctuous. This is the kind which prevails, and has wrought ſuch wonderful improvements, in Norfolk; ſo that land which not fifty years ago let for eighteen pence an acre, now brings twenty ſhillings, only by the proper uſe of this excellent manure. The Norfolk farmers act very wiſely in mixing it with dung, to dreſs their land: as this falls immediately to powder, its effects are more rapid*.

Shell marle is of a different nature from the above. It does not diſſolve in water, but abſorbs and ſwells with it, like a ſpunge. It attracts acids more forcibly: but the principal difference between this and the others is, that the ſhell contains a greater quantity of oil. This is therefore ſuppoſed to increaſe vegetation, by adding to the food of plants; by communicating to the ſoil the power of attracting this food from the air; by dividing the ſoil into ſmall particles, and by preparing the vegetable food for being abſorbed by the roots of plants. As this does not exhauſt land like lime, or the other marles, it may be repeated over and over. Its effects are alſo more ſudden. Marles have not the corroſive quality of lime*.

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* Bath Soc. Tranſ. Vol. I. p. 65.

Stone and clay marle is either grey, blue, brown, yellow, red, or mixed. It is eaſily known by ſeveral marks; ſuch as its breaking into little ſquare bits; its falling into pieces with a ſlight blow, on being expoſed to the ſun or froſt; its feeling fat or unctuous; and its looking, when dry, after having been expoſed to the weather for ſome time, as if it was covered with a hoar-froſt, or ſprinkled with fine ſalt. Even when mixed with the land manured by it, the whole ſurface of the ſoil will have that whitiſh appearance. But the moſt certain criterion by which we judge of marle, is, to take a little piece, perfectly dry, and drop it in a glaſs of clear water, where it will ſoon diſſolve into a ſoft and almoſt impalpable pulp, ſhooting up many ſparkles to the ſurface of the water. To this pour a little aqua fortis, and if it effervеſces, it is a ſufficient proof of its being a real marle. Fine fat clay will diſſolve in water, the ſame as marle, but will not effervеſce with the acid. Limeſtone or chalk will effervеſce with the acid, but will not diſſolve in water. Marle alone will both diſſolve and effervеſce. It is true that ſome marles effervеſce but little with acids; but they ſhould always be put to the trial; becauſe, the more they effervеſce with them, the more valuable they are as manures. In hot weather, good marle will ſlack with the heat of the ſun, like lime; eſpecially, if any rain follows a hot day*.

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* Encyclopedia Britannica, Article *Agriculture*.

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* Marle, lime, or any other calcareous earth, ſays Dr. Fordyce, applied to land, act in this manner:—they haſten the putrefaction of all putreſcible ſubſtances in a ſoil; conſequently, if there be not added at leaſt a proportional quantity of dung, well mixed, containing mucilage, they muſt infallibly exhauſt land; for they convert all the putreſcible matter therein to mucilage, much ſooner than it would be otherwiſe converted. This will make the land produce much greater crops than uſual, there being ſo much additional food prepared for the plants; but after two or three years theſe heavy crops will have conſumed moſt part, if not all the mucilage; and the little that may remain is converted into ſalts by the ſecond ſtage of putrefaction, which ſalts in a little time are rendered of no effect; or if they have any effects, they are

The farmers in Staffordſhire reckon the ſoft blue marle, which is moſt commonly found under clay, or low black ground, ſeven or eight feet deep, the beſt for arable land; and the grey ſort the beſt for paſture. That which is of a browniſh colour, with blue veins in it, and little of chalk or limeſtone, generally lying under ſtiff clays, and hard to dig, is moſt eſteemed in Cheſhire. The marle which is uſually found at the depth of about two feet or a yard, on the ſides of hills, and in wet boggy grounds which have a light ſand in them, is very fat and cloſe, and is reckoned the ſtrongeſt of all marles; for which reaſon it is particularly good for ſandy lands. This is commonly called peat marle, or delving marle. The paper marle, as it is ſometimes called, frequently lies near coals, and flakes like leaves or pieces of brown paper, than which, it is ſomewhat of a lighter colour. That which ſome writers call clay marle, becauſe it looks like clay, is very fat, and ſometimes mixt with chalk ſtones. Steel

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are hurtful to vegetation, if without mucilage; and thus the ſoil becomes quite exhauſted, and a mere caput mortuum.

One great benefit which lime, marle, &c. yields to land, is, that if there be any iron, copper, or ſulphur (which are poiſonous to plants) diſſolved in the acid juices of the ſoils, lime, marle, &c. will attract the acid and let go the iron, &c. which when become ſolid in a heap, can do no harm to land.

marle breaks of itſelf into ſquare cubical bits. Theſe two laſt kinds lie generally under ſand or clay; ſometimes about a yard deep under the former, but often much deeper under the latter. Stone, ſlate, or flag marle, which is a kind of ſoft ſtone, or rather ſlate, of a blueiſh colour, is commonly ſaid to be the beſt. It eaſily diſſolves with froſt or rain, is found near rivers, and on the ſides of hills, and is a very laſting manure.

There are four ſorts of marle in Suſſex, viz. grey, blue, yellow, and red. The blue is accounted the beſt, the yellow next, and then the grey. The red is the leaſt durable. A great deal of marle in the north country runs much upon the loam; but that in Suſſex is more like fuller's-earth, and therefore muſt certainly be the fatteſt. Mr. Mortimer ſays he ſaw a ſample of marle from Derbyſhire, which was very fat, though it contained ſo much ſand, that when wet it could not be wrought into a ball, or be made to hold together. This marle did well on clayey land, becauſe it was of an opening quality. I have indeed been informed from good authority, that marle which was compoſed chiefly of ſand and calcareous earth, inſtead of improving, has been found to be extremely prejudicial to light ſoils. So that even this beſt of manures muſt be uſed with judgment, and diſcretion.

In many parts of moſt counties of England, marle diſcovers itſelf to the moſt negligent eye; particularly on the ſides of broken hills, or deep hollow roads. Many rivers are bordered with treaſures, which are plundered by every flood. Boggy lands frequently cover it, and in them it ſeldom lies above three feet deep. It is ſomewhat lower under ſtiff clays and marſhy level grounds. The loweſt parts of moſt ſandy lands abound with it, ſometimes at the depth of three feet, and ſometimes at ſeven, nine, or more. It often happens, that the depth of the marle itſelf cannot be found; for when the cover is removed, all that can be dug is marle, to ſo great depth that there are few inſtances of a pit's being exhauſted.

Some exceptions there are, however, to this rule; for I myſelf diſcovered one which lies about five feet under the ſurface, and the ſtratum of marle is not above four feet thick. Under it lies a ſtiff clay, and beneath that, a rock of chalk. This marle conſiſts of a mixture of clay and mild calcareous earth, in the proportion of eighty of the latter to thirty-two of the former. A better manure cannot be for clayey land, of which the farm where this was diſcovered chiefly conſiſts; and the farmer is now about taking every advantage from ſo fortunate a diſcovery.

Nothing is more common, than to find the ditches which incloſe a field dug ſo deep, that they have penetrated ſix or ſeven inches into a bed of marle, without the farmer's taking any notice of it. Where it is thus accidentally diſcloſed, it not only turfs the ſides and tops of the banks, and thereby ſecures them, but makes the graſs grow ſo long and thick, that, when beaten down, it hangs as if it thatched the earth which nouriſhed it.

The Marquis of Turbilly recommends to every farmer, to bore his fields in various places, in order to know what ſtrata lie under his ſtaple; which may not only direct him as to the nature of the crops he ſhould grow, but may alſo diſcover great reſources in the cultivation of his lands. It is ſaid, that the firſt diſcovery of the fine marles of Norfolk was purely accidental; and to this accident that county owes its vaſt improvements; as it has afforded the moſt effectual means of enriching its native ſandy ſoil.

Happily for Ireland, marle is very common in that country; where it ſeldom lies above a foot or two beneath the ſurface of the ſoil. But in France, though they have marle in many places, they are often obliged to dig for it very deep, in ſome parts eighty or ninety feet, where they find it in beds of about five feet thick.

Authors differ widely, both as to the quantity and the manner of uſing almoſt all the manures they treat of: points which muſt, in a very great degree, depend on the quality of the ſoil, and the ſtrength of the manure, of whatever kind it be; in which, experience will ever be the judicious farmer's ſureſt guide. In marling, it is particularly neceſſary to find the true proportion which the land requires: and it is better to err in laying on too little, than too much; becauſe more may be added at pleaſure; whereas, by overdoing it, the firſt year's crop often fails, from the body of the marle not being ſufficiently opened, pulverized, and mixed with the ſoil; and for theſe reaſons it will ſometimes be two or three years before the ſoil comes to a proper temper. The diſcreet and ſenſible farmer muſt therefore judge what may be a ſufficient quantity to give the degree of tenacity and coheſion required by the light ſoil upon which it is laid.

Strong ſoils require infinitely leſs, becauſe to them it is not applied as a corrective, but as an enriching and fertilizing manure; and for this reaſon, where a marle can be obtained abounding with ſand or calcareous earth, it is much the fitteſt for ſuch lands.

Pliny ſpeaks of marle as a ſpecies of improvement known to the Greeks, but more peculiar to

Britain and Gaul: he terms it the fat of the earth.

Dr. Home obſerves, that a body very ſimilar to marle, in its appearance, but eſſentially different in its effects, is often found in the ſame bed with the beſt marle. It is of a darkiſh lead colour: inſtead of fertilizing, it renders even the beſt ſoils incapable of bearing any kind of vegetables for many years. He has obſerved the ſpots on which it was laid entirely barren three years after; and had heard of the bad effects continuing in other places for a much longer ſpace of time: nor is it certain when they ceaſe. A body ſo very deſtructive to agriculture deſerves to be well characterized, in order to its being ſhunned; and ſhould be thoroughly examined, that we may know whence proceeds this noxious quality, and how to cure it, where it has been inadvertently applied.

Marle takes a ſmooth poliſh from the inſtrument with which it is wrought. A piece of the other, taken up when it has not been much expoſed to the influence of the air, differs greatly in taſte from marle. Inſtead of the ſmooth unctuous taſte of the latter, it is acid, and remarkably aſtringent. It agrees with marle in crumbling in water; but differs in not raiſing any effervеſcence with acids, nor in the leaſt deſtroying their acidity. It turns the ſyrop of violets red, which plainly ſhews it contains an acid; whereas marle, like all abſorbent earths, gives it a green colour. The trying of marle with acids is therefore the more neceſſary, to guard againſt uſing this pernicious ſubſtance.

It appears from experiments made by the Doctor, that this ſubſtance conſiſts of an earthy body, like clay, an eighteenth part of ſalt of ſteel, and a ſmall proportion of vitriolic acid: from whence he concludes, that good marle is the proper cure where this noxious earth has been inadvertently uſed, becauſe it corrects the acid, and decompoſes the ſalt. Miller, upon the article of marle, obſerves, that ſome people have adviſed to burn it, before it is laid on land; in which caſe one load will go as far as five. I have tried this, and found that it improved and ſtrengthened the marle. This may be a valuable piece of information to thoſe who lie at a great diſtance from marle, who muſt then calculate whether the additional expence of burning is compenſated by the ſaving of carriage. To thoſe whoſe marle pit lies near at hand, the burning muſt be an extra expence.

SECTION IV.

Of Loams.

LOAMS, or what are ſometimes called Brick Earths, from their anſwering beſt for that purpoſe, are clays already meliorated and corrected by the hand of nature. They have, in their firſt formation, been rendered mild and friable, by the mixture of black mould, ſand, or gravel; and according to the proportion of theſe ingredients, they are more or leſs fertile. Some, having too ſmall a portion of theſe correctives, retain a hardneſs and toughneſs, unfriendly to vegetation, in the manner already deſcribed; while others, more looſe and tender, eaſily yield to the ſhare, and pulverize with the harrow. Next to the pure black mould, loams are doubtleſs the moſt grateful to the huſbandman. Nature has ſhortened his toil, and prepared his way: for in the friendly loam he has only to plow, to pulverize, to clean, and manure, and his returns will be abundant. This is that happy mediocrity of ſoil, which beſt ſuits all plants, and is moſt productive in all ſeaſons. There are, however, ſome combinations of theſe ſoils, which are of very inferior qualities: ſuch as are overcharged with ſharp and hungry gravels; or where the upper-ſtratum, or ſtaple, is ſo thin, that chalk-rubbiſh, or cold clay, lying beneath, is turned up by the plough in too great quantities, and vitiates the ſoil. To ſuch ſlender, ſteril ſoils as theſe, I can ſay from experience, there is no manure half ſo effectual, as a large quantity of good mould, brought from the neareſt ſpot it can be procured. The benefit ſuch a ſoil will receive from an increaſe of rich and freſh ſtaple, is far greater than from a dreſſing of dung, or any dry manure. Forty cart loads to an acre is the leaſt that ſhould be given: but in this it is impoſſible to overdo, when it can be afforded.

A neighbour of mine, who holds a large farm, has made great improvements by this mode of proceeding. The accumulations of mould by the rotting of leaves and other vegetables, about hedges and hedge rows, forming what are here called brows, have afforded him ample ſupplies. Beſides the brows, there are rich collections of mould in hollow grounds, into which the ſoil from the higher lands has been continually waſhed, during a long ſeries of years; and theſe repoſitories of rich manure have been ſucceſsfully ranſacked both by my neighbour and myſelf.

The quality of ſoils may be nearly gueſſed at in ſeveral ways: moſs, ruſhes, wild tanſy, ſedge, flags, fern, yarrow, and withered, blaſted, ſhrubby, and curled plants, are natural indications of a bad ſoil. The taſte and goodneſs of the water which runs, or is ſtrained through it, is another rule for judging of the ſoil. Alſo from the ſmell, which, upon the firſt falling of rains after long drought, is very pleaſing, and even fragrant, from good and natural mould; but diſagreeable and nauſeous, if the ground contain any mineral, or other ill quality; as is remarkable in marſhes and fenny places.

The taſte of the ſoil is likewiſe a guide to the ſkilful obſerver: all earths, as well as plants, abounding more or leſs in their peculiar ſalts; ſome ſweet, and grateful; others bitter, hot, or aſtringent; others flat, and inſipid; eaſily diſcovered by lixiviating with ſweet water a parcel of the mould taken out of that part which is deemed the worſt. The lye drawn off, will retain the taſte of the earth lixiviated.

The touch will ſhew whether the ſoil be ſoft, pliant, fat, and ſlippery; whether it ſticks to the fingers, or melts and diſſolves on the tongue; in which caſe, it may be accounted rich. But if it be gritty, light, and porous, it is then of an inferior quality.

Mould fitteſt for the production of plants is of an uniform ſubſtance, unmixed with the contrarieties of ſoft and hard; churliſh and mild; moiſt and dry: neither is it too unctuous, or too lean; but light, and crumbles eaſily; yet is conſiſtent enough to be wrought and kneeded. It is of ſuch due coheſion and tenacity, that it neither ſoils the fingers, nor cleaves much to the ſpade, which eaſily enters it. Of this kind is the mould uſually found under the turf of paſture lands, upon which cattle have been long fed and foddered. In ſhort, that is the beſt mould which is the blackeſt, cuts like butter, ſticks not obſtinately, breaks into ſmall bits, ſmells ſweet, is ſo tempered as neither to cruſt, or chop in dry weather, or become poachy in wet; which ſhines after the plough, where flocks of crows follow the ploughman, and, as Pliny expreſſes it, peck at his very heels.

As to colour, next to the blackiſh, the pre-eminence is generally given to the darker grey, and after that to the ruſſet: the clear tawney is reputed worſe; the light and dark aſh colour, light of weight, and reſembling aſhes, good for little; and the yellowiſh red, the worſt of all.

SECTION V.

Of Chalky, and Mother-ſtone Lands.

THESE two ſoils, though very different, yet reſemble each other in ſome circumſtances. They do not, like others, take their names from the ſuperficial ſtrata of earth, or ſtaples, but from the ſtrata which lie immediately under thoſe ſuperficial ones. Thus, a chalky ſoil is the ſoil, or ſtaple which lies over a body of chalk, and which may, in ſome meaſure, partake of the nature of that body; being mixed with the chalk by repeated plowings, and otherwiſe. But beſides this, the ſoil, or ſtaple, is greatly affected by the body, or ſtratum, under it, in another way, which is common both to the chalk and the mother-ſtone: for if the ſuperficial ſoil, or ſtaple, is thin, it will be extremely wet in the winter; the moiſture being prevented from ſubſiding, by the cloſeneſs of the under-ſtrata; and it will be as much too dry, and parched in ſummer, as the ſun and wind will ſoon exhale the moiſture, which, as before obſerved, can go no deeper than the ſuperficial ſtrata. If, therefore, theſe ſuperficial ſtrata are very thin, perhaps from four to eight or nine inches thick, which is often the caſe, ſuch lands will turn to beſt account when in graſs: 1, becauſe they are extremely troubleſome to plow, the ſhare often grinding againſt the chalk, or ſtone, and ſometimes getting entangled in them. 2, becauſe, when plowed, they are more expoſed to the ſoaking of wet and the ſcorching of the ſun. 3, becauſe the ſoil is too thin and ſhallow, to bring good crops. For theſe reaſons, I would always recommend them to be laid down to graſs, either natural or artificial. Sainfoin and burnet ſucceed beſt on ſuch ſoils; and they bear alſo a ſweet natural graſs. All theſe ſhade the ſoil in ſummer, and prevent it from being ſo much parched, as it would otherwiſe be.

This thinneſs, or ſhallowneſs of the ſoil, or ſtaple, being the principal defect of theſe ſoils, is beſt remedied by adding to them a body of mould, or of a compoſt ſuitable to the ſtaple: that is, if the ſtaple is clayey, add a ſandy compoſt; but if it be ſandy, or otherwiſe light, uſe a clayey compoſt, if this can be done at a moderate expence: for I would always adviſe every farmer to calculate his probable out-goings and in-comings, with great circumſpection, before he undertakes any improvement. But ſhould good mould or compoſt be uncomeatable at a moderate expence,

there

there is another obvious method of ſupplying the deficiency, which is, by dividing the field into broad lands, ſeparated by alleys; the alleys, or intervals between the lands, ſhould be dug out, down to the under-ſtratum, whether chalk or mother-ſtone; and the mould thus dug out, ſhould be laid over the lands. By theſe means, the ſoil of the lands, or ridges, would be greatly deepened, and the alleys, or intervals, would become open drains, to carry off ſuperfluous moiſture. It is true, this would diminiſh the quantity of land; but it would infinitely improve the remainder. The Dutch burn large quantities of their ſpices, to render the reſidue of much greater value.

The ſame eaſy cure may be applied to wet lands, where the moiſture is ſuperficial, and not deep in the ſoil; or where meadows are inundated, from ſome accidental cauſe; ſuch as rivulets ſwelled by rains, &c. By making alleys as above deſcribed, the lands, or ridges are raiſed above the moiſture, and the alleys become drains for receiving the ſuperfluous waters.

That ſoil which lies over chalk, and partakes of its nature, being ſhort and crumbling, is eaſily got into tilth: from this ground, weeds grow leſs than on any other whatever. Two plowings, therefore, of this ſoil, will do as much ſervice as four will in red clays: which makes the farmer ſay, A fallow and a half is enough for chalk. Mr. Ellis obſerves, that all grain ſhould be ſown in this ſoil in wettiſh weather, becauſe it is then made ſomething clotty, and rough, which beſt hinders the growth of its only, and moſt pernicious weed, the poppy. It is alſo made more binding, and tenacious by wet, and will ſtand the froſts and cold much better; whereas a fine tilth in this ſoil is objectionable; for as chalks are naturally light, and looſe of themſelves, they are made more ſo by being rendered fine; and then the wheat and other grain will fall before the high winds, and be lodged, and ſpoilt.

The marly clay ſort will admit of a greater depth of plowing, and the loamy chalks ſtill more, than the former. Rolling is very neceſſary for theſe lands, to preſerve them from the ſummer's drought, and to keep the ground firm and cloſe to the roots of the grain.

The very worſt of theſe chalks, which are of a looſe and ſtony nature, will bear, when well dreſſed, good wheat, rye, barley, peas, thatches, and lentils: but where this dreſſing cannot be given, they are commonly ſown for Lent-grain. Lentils and vetches will grow and flouriſh in the pooreſt chalks; as may annually be ſeen on Dunſtable Downs*.

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* Ellis, Vol. I. page 25.

SECTION VI.

Of Uncultivated Lands.

BY lands which ſtill remain in an uncultivated ſtate, is meant, ſuch as are not ſufficiently drained to admit of plowing; ſuch as are covered with wood; and commons, or grounds that produce nothing but heath, broom, furze, fern, &c.

Although the component parts of uncultivated lands are actually the ſame with thoſe that conſtitute ſoils which have been in a ſtate of culture; yet there are peculiarities attending the former, by means of adventitious matters which enter into their compoſition. Theſe muſt be carefully attended to, and either removed, or corrected; without which, it would be impoſſible ever to bring ſuch lands into a ſtate of cultivation and improvement.

In order to explain with accuracy the nature of uncultivated lands, I ſhall divide them into four different claſſes; viz. Bog*, Moorland, or Moſs,

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* Theſe lands are called Moors in England, Moſſes in Scotland, and Bogs in Ireland.

Moſs; Marſh land; Wood land; and Common, or Heath.

CLASS I.

BOGS, Moſſes, or Marſh, like any other of the ſoils before mentioned, may have originally conſiſted of black mould or clay; or ſand and gravel; or loam; or their various combinations as before deſcribed. In addition to this, however, the Boggy land has acquired a ſuperfluity of moiſture, and other extraneous matter, mixed with the ſoil ſo intimately, that no improvement of it can take place, till the former is removed, and the latter effectually corected; in order to accompliſh which, both art and induſtry muſt be employed.

Mr. Mills, in his Complete Syſtem of Huſbandry, Vol. I. page 123, gives us the following ingenious account of the formation of Bogs, or Moor land.

« When the various countries of Europe were thinly inhabited, the lands lay uncultivated, and the ſurface of the earth was covered with trees, and other plants, moſt of which died, and rotted where they grew. Their leaſt periſhable parts mixed with the native mould, and formed by degrees that new ſurface called moor, or moorland, which is generally met with, on large extended plains. This was particularly the caſe, where clay, or other ſubſtances impervious to water, lay under the ſuperficial mould. Where the ſurface was ſand, theſe vegetable, and ſometimes animal putrefactions, ſunk through the ſuperficial ſtratum, and probably formed that rich fertile ſubſtance, which is always found under ſand, and gravel, and which is diſtinguiſhed by the name of marle; though, at the ſame time, there undoubtedly is a calcareous ſubſtance, nearly akin to chalk, which is alſo well entitled to the appellation of marle. Thoſe marles muſt not, however, be confounded with that, which is often found in places that were formerly the beds of rivers, or receptacles of great bodies of ſtanding water. In theſe, the marle is chiefly compoſed of ſhells, now almoſt totally diſſolved, and mixt with the fineſt earth. The marle here ſpoken of, on the contrary, ſhows no ſigns of ſhells, but ſeems to conſiſt of the fineſt earth, and of the ſaline and oily particles of animals and vegetables, waſhed down by the rain, and intimately blended together. Thoſe oils account for its unctuous feel; as the calcareous matter, and other ſalts do, for its eaſy ſolution in water.

"This opinion is greatly confirmed by the channels which are frequently traced through ſand, and gravel, plainly indicating a deſcent of ſuch matter, and by the marle's being always richeſt the deeper we dig into it.

"Where theſe ſubſtances are retained on the ſurface, the finer parts, in the former caſe waſhed through the ſand, here become volatile, and leave their coarſer and more durable particles to form the mooriſh earth.

"Where trees, and ſhrubs have died thus, and fallen, eſpecially in a hollow place, where water has been confined among them, their putrefaction goes on more ſlowly. In the mean time, fine rich mould is brought by winds, by water deſcending from high grounds, &c. which, mixing gradually with the water, and vegetable ſubſtances already buried in it, acquires in time a conſiſtence, which gives riſe to certain plants, and thus proceeds, till the whole is converted into that ſolid ſubſtance, called peat. In this caſe, the oils of the vegetables, and of many animals which periſh in the water, are entangled in the rich mould mixed with the water; and their total putrefaction being prevented by the mineral acid in the water, they become of that bituminous quality which is found in peat."

As large tracts of the ſurface of the earth are covered by one or other of theſe moulds, which, not being abſolutely an original ſoil, could not be comprehended under any of the diviſions already treated of, they deſerve our particular attention here. In order to proceed with regularity, it will be neceſſary to deſcribe a little more fully what is meant by Moors, Moſs, and Boggy land; next, to give directions for draining them, and then to point out the means by which they may be improved.

ARTICLE I.

Deſcription of Moor, Moſs, or Boggy Land.

THE moſt common kinds of the uncultivated lands is that which is called Moor. It is generally a fine black mould, and is ſometimes found under a very thick ſwerd of graſs, but more frequently under moſs, or ſtraggling plants of heath. It differs from peat, in not ſticking together; nor has it the fibrous roots, or bituminous viſcous quality of the peat. Peat, when dry, becomes hard, and firm; this falls into powder. It cannot be better deſcribed, than by comparing it to that ſubſtance which is found in hollow rotten willows, and other trees of that kind: which gives room to think, that it ariſes from rotten plants. It is of a ſpungy nature, and ready to imbibe moiſture, which adds conſiderably to its weight. There is generally underneath it, as under moſt earths of this kind, a bed of clay, or ſome ſubſtance impervious to water: ſo that the particles of bodies decayed on their ſurface, not being admitted into the ſoil, remain upon that ſurface, dry there, and increaſe its thickneſs according to the continuance of the cauſe.

If this kind of ſoil is collected in a place where running water, in rainy ſeaſons, brings with it clay, or other fat ſoils, it then acquires a greater degree of cohesion, hardens when dry, and reſembles the cleanſing of ponds.

The moſt conſiderable ſoil of this kind, is that ſort, called peat. This is uſually full of roots of weeds, and even of trunks, and branches of trees, and other plants. It always contains a bituminous oil, which renders it very inflammable when dry; at which time it alſo becomes very hard, though it is quite ſoft when in its native bed, from which it is uſually cut in the form of bricks, for fuel.

The whole maſs and body of this ſoil is a dunghill, made up of rotten timber, graſs, and weeds, with a mixture of mud waſhed from the higher grounds, by land-floods; than which there are few richer compoſts: only, by age, and its cold ſituation in water, its ſalts are weakened, and its ſpirit is become languid. The ſame will happen to the richeſt dunghill that can be made, of any compoſition whatever, if too long kept. It will even become ſuch, as not to be diſtinguiſhed by the eye from ordinary moſs; nor will it be more uſeful as dung, except either in proportion to the ſhorter time it has been kept, or the better ſituation of the place where it has ſtood. I believe, the qualities of Moſſy, or Boggy lands differ very little from one another in any other reſpect, than with regard to the better, or worſe quality of the mud, which makes part of their compoſition. They are more or leſs ſpungy, in proportion as this rich mud fills up the cavities of the component vegetables which are preſerved from putrefaction by the acid in the water. The leſs ſpungy, and more rotten the Moſs, or Bog, is, the fitter it is for the vegetation of any thing planted or ſown in it.

Mr. King, in his account of Bogs in Ireland, imputes the true cauſe of them to want of induſtry; as a proof of which, he inſtances a large tract of ground in the county of Connaught, which was plowed land when O'Donal and Tirone laid waſte that country, in their march to the relief of Kingſale, and is now a Bog, in the midſt of which the old manſion-houſe ſtill remains.

The ſprings, ſays he, with which Ireland abounds,

bounds, are generally dry, or nearly dry, in the ſummer time, and graſs and weeds grow thick about the places where they burſt out. In the winter, they ſwell, run, and ſoften and looſen the earth about them. The ſwerd, or ſcurf of the earth, which conſiſts of the roots of graſs, being lifted up, and made fuzzy by the water in the winter, is dried in the ſpring; and does not fall together, but withers in a tuft, through which riſes new graſs; which is alſo lifted up the next winter. By theſe means the ſpring is more and more ſtopt, and the ſcurf grows thicker and thicker, till at firſt it makes what is called a quaking Bog; and as it grows higher and dryer, and the roots of graſs, and other vegetables, become more putrid, together with the mud and ſlime of the water, it acquires a blackneſs, and grows into that which is called a turf Bog. I believe, that when the vegetables rot, the ſaline particles are generally waſhed away with the water, as being apt to be diluted in it. The oily and ſulphurous, are thoſe which chiefly remain, and ſwim on the water; and this is what gives turf its inflammability.

There are quaking Bogs cauſed otherwiſe. When a ſtream, or ſpring runs through a flat, the paſſage, if not attended to, fills with weeds in ſummer; trees fall acroſs it, and dam it up:

then, in winter, the water ſtagnates further and further every year, till the whole flat is covered. Afterwards, a coarſer kind of graſs ſhoots up, peculiar to theſe Bogs. This graſs grows in tufts, its roots conſolidate together, and its height increaſes every year; inſomuch that it is often ſeen as tall as a man.

This graſs rots in winter, and falls on the tufts, and with it the ſeed, which ſprings up the next year, and ſo ſtill makes an addition. Sometimes, the tops of flags and graſs are interwoven on the ſurface of the water, and this becomes by degrees thicker, till it lie like a cover on the water: then herbs take root in it, and by the matting of theſe roots it grows ſo ſtrong as to bear a man. Mr. King ſays, he has gone on Bogs which have riſen before and behind him, and ſunk where he ſtood to a conſiderable depth, under which was clear water.

As a further proof that want of induſtry is the principal cauſe of Bogs, he obſerves, that the higheſt mountains in Ireland, being full of ſprings, and uninhabited, are over-run with Bogs, as well as the plains, becauſe no care is taken to clear the ſpring, and preſerve the water-courſes.

Ireland, continues he, abounds in moſs more than any other kingdom. This moſs is of divers kinds, and that which grows in Bogs is remarkable.

able. The light ſpungy turf is nothing but a congeries of the threads of this moſs, before it is ſufficiently rotten. The turf then looks white, and is light: and he has ſeen it in ſuch quantities, and ſo tough, that the turf-ſpades could not cut it. In the north of Ireland they call it Old Wives Tow, being not much unlike flax. The turf-holes, in time, grow up with it again; and all the little gutters in bogs are generally filled with it. To this Mr. King chiefly imputes the red or turf bog; and from the ſame cauſe, even the hardened turf, when broken, is ſtringy; though there plainly appear in it, parts of other vegetables.

A flat ſpot of ground, lower than the level of an adjoining river, or lake, may alſo give riſe to a bog; for when that part is filled up by the ſlime and earth brought from the ſurrounding grounds, and the rotten plants and animals which are buried in it, have choaked it up, it will become a bog; and then the water will continue to flow into it, from the river, or lake, eſpecially when ſwelled by a fall of rain, or the melting of ſnow. Theſe waters may alſo ſometimes have this effect, without a communication above ground, by ſoaking through a ſandy, or gravelly ſoil.

Another cauſe of bogs has frequently ariſen from the fall of a number of trees, which, lying neglected, have neceſſarily cauſed a ſtagnation of the water brought down from higher grounds; ſo that the earth and other ſoil conveyed with it, have of courſe remained among the fallen wood, and given birth to a moſſy ground, which, it is plain from hence, is not an original ſoil. Coarſe graſs, and weeds, which cattle will not eat, ſpring up in theſe places, and then die, after ſhedding their ſeeds, which, being prevented from rotting, by the bituminous acid in the moſſy water, produce new plants; and this repeated every year, an annual addition is made to the depth of the bog or moſs.

Lord Cromarty, in a letter to the Royal Society, relates a remarkable inſtance of this kind.

In the year 1651, a little plain, by the ſide of a ſteep hill, was covered over with a ſtanding wood, ſo very old, that the trees had no leaves, and even their bark was thrown off. Fifteen years after, having occaſion to ſee the ſame place, he called to mind the old wood, of which there was not now a tree, nor even the appearance of a root, remaining; but inſtead thereof, the whole bounds where the wood had ſtood, was all over a plain green ground. Having then inquired, what had become of the wood, he was told by the country people, that the whole was overturned from the roots by winds, where they lay ſo thick, that the moſs had overgrown them; and added, that this was occaſioned by the moiſture which came down from the hill, and ſtagnated on the plain. Before the year 1699, the whole piece of ground was turned into a common moſs, or bog, where the peaſants dug turf and peats. The peats, however, were not then in great perfection, being ſoft and ſpungy, but they grew better every year.

Another inſtance, of the ſame kind, is related in the tranſactions of the ſame Society.

Abundance of oak, fir, and other trees, has been frequently found in the moor, in that fenny tract, called the Iſle of Acholme, lying part in Lincolnſhire, and part in Yorkſhire. Some of theſe oaks are five yards in compaſs, and ſixteen yards long; others are ſmaller and longer, with good quantities of acorns ſtill lying near them, ſomewhat above three feet deep, and about their roots, which yet ſtand as they grew in firm earth below the moor; many of the firs, which lie a foot or eighteen inches deeper than the oaks, and in greater numbers, are thirty yards long. One of them, taken up not many years ago, meaſured thirty-ſix yards, beſides the top lying alſo near the root, which ſtood as it grew. Mr. Dugdale thinks, that this place has been a moor for many ages, and that the original cauſe of it was the muddineſs of the tides, which flowing up the

Humber into the Trent, left in time ſo much filth, as to obſtruct the currents of the Idle, Dun, and other rivers, which thence flowed back, and overwhelmed the country.

The bottom of bogs is generally a kind of white clay, or other ſandy marle. A little water makes it exceeding ſoft; and when it is dry, it is all duſt. The roots of graſs do not ſtick faſt in it; but a little wet looſens them, and the water eaſily gets in between them and the ſurface of the earth, which it lifts up, as a dropſy does the ſkin. It is more than probable, that great quantities of ſhell-marle may be found under bog, or moſs land, eſpecially where the ſea has formerly flowed*. I have been aſſured, that this is almoſt conſtantly the caſe in Scotland.

As to their ſituation, the mooriſh earth often lies on ſmall eminences, moſt commonly where there is no ſtagnating water. If water does ſtagnate there, the ſoil becomes the richer. Peat-grounds are generally found where there has been a depth of ſtanding water, occaſioned either by a hollow on the ſurface, or the currents being ſtopped, as mentioned by Lord Cromarty. The rich paſtures along the banks of the Trent have probably been formed by the ſame means; for when ſwampy lands have been covered with a bed of earth, brought to them from higher grounds, by inundations, they often become excellent meadows, amply ſtored with very fine graſs.

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* The very ingenious and ſcientific Dr. Hutton has clearly demonſtrated the origin of all theſe ſtrata of ſhells, &c. Roy. Soc. Edin. Tranſ. V. 1. p.

ARTICLE II.

Of Draining Bogs, or Moorlands.

BOGS are attended with ſo much inconvenience in any country, that it is a matter of real importance to the inhabitants, to have them drained.

In the firſt place, they are extremely dangerous to cattle, which in ſpring are weak and hungry: the edges of bogs are commonly cloathed with graſs; and theſe beaſts, in venturing to get at it, fall into ſloughs, where they are either drowned, or hurt, or maimed in pulling out. The fogs and vapours which ariſe from theſe places, are commonly putrid, ſtinking, and unwholſome; for the rain which falls on them ſtagnating upon their ſurface, there corrupts, is exhaled by the ſun, and affects the air.—They alſo corrupt other water, both in colour, and taſte; for the water which ſtands in the pits, or on the ſurface of the bog, is tinctured by the reddiſh-black colour of the turf; and when a ſhower comes, ſo as to make theſe pits overflow, the water which runs from them tinges all it meets, and gives colour and ſtench, even to rivers. The only advantage ariſing from bogs is, the turf for fuel. It makes a tolerable ſweet fire, in the common way of uſing it; and when charred, is perhaps the ſweeteſt and wholeſomeſt thing that can be burnt, fitter for a chamber, and for conſumptive people, than either wood, or coal.

All theſe inconveniencies of Bogs may be removed; and, by draining, they may be converted into moſt uſeful grounds: for there are ſcarcely any to be found, that have not in ſome quarter a ſufficient fall, to admit of draining. The great objection againſt this improvement is the expence; in which people are often frightened without cauſe. One trench will drain many acres in quaking bogs, which when dry are generally meadow, or at the beſt grazing land. Every red bog has round it a deep, marſhy, ſloughy ground, which is called the bounds of the bog. A deep trench round ſuch a bog, keeps out cattle, and turns the bounds into good meadow. Mr. King ſays, he remembered a red bog of ſixty acres, which a gentleman reduced to a good grazing ground, worth three ſhillings an acre, for twenty-five pounds; which is leſs than three years purchaſe. In all improvements of this kind, gentlemen ſhould conſider, that what they lay out goes by degrees, ſo that they ſcarcely feel it; that it goes among their tenants, whom it helps to pay their rent; that they do a work of charity, in employing the poor; and that they at the ſame time contribute to the ornament, to the profit, and to the ſalubrity of their native country.

The deep trench as before mentioned, round a red bog, not only drains and improves the bounds of the bog, but goes a great way towards drying the bog itſelf. It ſerves alſo as a common ſewer, into which all the leſſer drains are to empty themſelves. It is therefore of conſequence, that the main drain, or ſewer, ſhould be preſerved free from any ſtoppage or incumbrance: and for this reaſon I would recommend, that it ſhould be made conſiderably wider above, than below, ſloping gradually on both ſides. This will be attended with ſeveral advantages: the great breadth will deter cattle from leaping over it; it will be leſs apt to be undermined by the current of the water, or to ſlide down and ſtop it, in its courſe.

The ſmaller drains ſhould be of the ſame form, and ſhould be cut ſo as to croſs the little ſloughs that run in the bog. The firſt drains need not be above two or three feet deep, or wide: for the bog is generally ſo ſoft, that deep trenches will not ſtand, but will fill up again. When the ſurface of the bog is cut in ſmall trenches, ſuppoſe at twenty, thirty, or forty perches diſtance, it will ſoon be ſo dried, that cattle may graze upon it all the ſummer. A year or two after this, the drains may be widened, and made as much deeper as the ſoftneſs of the bog will permit. This will certainly make the bog uſeful for grazing; and in a year or two more, an attempt may be made to cut ſome of the trenches down to the bottom of the bog; for till that is done, the work is not complete.

A gentleman may oblige all his tenants, to cut their turf in theſe drains, and alſo have his own cut there.

Small bogs may be turned to very good account, by planting them with oſiers, willows, and alders: but where the extent is conſiderable, this object becomes of too little conſequence. Before they can be improved in any other way, they muſt be drained: as a previous ſtep towards which, it will be neceſſary to examine, from whence their too great quantity of water ariſes, and what retains it. When the cauſes are known, their effects will be more eaſily remedied.

The ſources from which the too great quantity of water proceeds, may either lie within or without the bog. The light mooriſh earth eaſily admits rain water, and if its ſurface be flat, may retain it a conſiderable time. But ſtill, rain can hardly be reckoned one of the cauſes here. Where this kind of earth is bordered by higher grounds, either rain, or running brooks from thence, may overflow it; but the moſt uſual ſources are within itſelf; occaſioned by ſprings which riſe in the bog. This is eaſily diſcovered by the greater moiſture in one place, than in another; and by obſerving, that the water ſpreads from thence, even under the ſurface, as through a ſpunge.

If the water from without comes from neighbouring grounds, it is uſually kept off by a ſurrounding ditch, made large enough to contain the quantity that may at any time flow down; and by carrying that ditch to the moſt convenient outlet, according to the declivity of the ground. If the bed of gravel, or ſand, from which the ſprings within the bog run, be cut quite through, the ſource of the evil will certainly be deſtroyed: and if that bed be only opened in digging this ſurrounding ditch, the water will ſo readily diſcharge itſelf thereby, that the ſprings will probably be dried up.

Before any drain is made in the bog itſelf, a level of the ground ſhould be taken; and when the too great moiſture proceeds from a ſpring or ſprings within the bog, a large ditch ſhould be made, beginning at the loweſt part of the bog, where an outlet can be had, and continued from thence to the ſpring. If the bog be firm enough to bear it, this ditch ſhould be dug to the very bottom of the bed, on which the peat or moſs is formed; which, in caſe of ſprings, is always gravel or ſand, with generally a bed of clay underneath. If the whole of the ditch cannot be of that depth, it certainly ſhould be, at the ſpring itſelf; for otherwiſe the water may force itſelf a paſſage in another part, and ſo make it neceſſary to extend the ditch thither. If there be more ſprings than one, the main ditch muſt be extended to each of them. In all caſes, the ſureſt way is to dig the ditch, where it can be done, at leaſt a foot deeper than the ſpring lies. Between the principal ditches cut in the bog, there ſhould be ſmaller ones, to carry off any remains of ſtagnating water, and to preſerve the ſurface dry. Care ſhould be taken, not to lay the earth dug out, too near the ſides of the ditches, leſt its weight ſhould make them fall in. The beſt way to diſpoſe of it is, to ſpread it equally over the ſurface of the land.

Bogs are generally higher than the flat lands immediately contiguous to them, and riſe higheſt towards their centre; the chief ſprings that cauſe them being commonly about the middle; from whence they extend by degrees, and puff up the earth in ſuch manner, that people are often apt to think the ſprings lie deeper, than they really do. A ſure way to know, whether the ditch be deeper than the ſpring is, to obſerve whether the water comes in at its bottom, or through the ſide. The width of the main ditch ſhould be proportioned to its depth; and both ſhould depend upon the quantity of water neceſſary to be carried off. In general, it ſhould widen progreſſively from its head to its outlet; becauſe the quantity of water will be conſtantly increaſing. I have already mentioned that the ſides of all ditches ſhould be cut ſloping, more or leſs, according to the nature of the ſoil. If this be very looſe and light, it may be neceſſary to have the ditch three or four times wider at top, than at bottom. The ſtiffer the ſoil is, the leſs ſlope it will require: but none ſhould be cut quite perpendicular.

If a deep trench be cut through a bog, the original ſpring will be found, vaſt quantities of water will iſſue from it, and the bog will ſubſide. Mr. King ſays, he found that a bog at Caſtle-Forbes, in Ireland, ſubſided no leſs than fifteen feet.

When the ditches and trenches are finiſhed, great care muſt be taken to keep them in a good and laſting condition. They ſhould be cleanſed of weeds and mud from time to time: ſtakes ſhould be driven down, where they are moſt apt to give way; or willows, which delight in a watery ſoil, may be advantageouſly planted on the banks, where the roots and fibres will help to bind them.

If it ſo happen, that a bog is entirely ſurrounded by high grounds, ſo that there is no outlet for conveying off the water; ditches muſt then be dug around it, to intercept the water from the neighbouring hills, and a large pond, or tank, muſt be dug in the loweſt and moſt convenient place, within or without the bog, for receiving the water; and when thus collected, an engine muſt be uſed to raiſe it to a proper height, for a channel to carry it off. The mould, thus dug out of the tank, may be uſefully employed on the adjoining land.

Some engineer, or, perhaps, a good intelligent mill-wright, ſhould be conſulted about a ſimple and uſeful engine for this purpoſe. If there be no ſuch perſon near, the proprietor would do well to have recourſe to Mr. Belidor's work upon Hydraulics, for ſome good and uſeful inventions of this kind*.

Land which lies lower than the level of a neighbouring river, or lake, apt to be overflowed by deſcending rains, or the melting of ſnow, is often covered with a boggy earth. In order to drain this land, it muſt be fenced from the river or lake.

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* *Architecture Hydraulique*, Tom. II. chap. 2. pl. 1.

This naturally leads to the ſubject of embanking, whether to keep out a river, lake, or the ſea. Sloping banks are by far the beſt ſecurity againſt any of theſe encroachments; and ſhould be raiſed a foot or two above the level of the water, at the higheſt tides, when impelled by the wind. The more gentle the ſlope, and the ſmoother it is laid, the waters and waves will glide along with leſs violence, or agitation; like turbulent and unruly tempers, which, meeting with oppoſition and reſiſtance, become outrageous and headſtrong; but when treated with mildneſs, and complacency, they move on unruffled, and inoffenſive. When a river is confined within a narrow channel, it ſwells upon a flood, and overflows its banks; unleſs thoſe banks are prepared to receive the increaſed ſtream, by being raiſed to a proper height, and ſloped with a gentle and equal declivity. It is only thoſe who are acquainted with the circumſtances of ſituation, the magnitude of the ſtream, the extent of its ſupplies, the force and direction of the tides and currents, that can dare to preſcribe the nature and extent of the remedy. It ſuffices in this work, to have ſuggeſted a cure, which, if judiciouſly applied, will prove effectual, and which has already been ſanctioned by ſucceſs.

We muſt however obſerve, that it is by far the wiſeſt way to do too much, rather than too little; and therefore I would recommend, to have the banks or glacis made ſufficiently ample for every ſwell. Theſe grounds are not loſt, but will afford good grazing in the dry ſeaſons of the year: for this reaſon, they may be ſowed with graſs ſeeds, to form a ſwerd: but I would by no means adviſe any plantations on ſuch grounds; as they would only create an oppoſition to the current of the ſtream, the bad conſequences of which have been already mentioned.

When earth is wanting to the formation of ſuch banks, ditches may be cut, on the outſide of them, next to the land. Theſe will anſwer two good purpoſes; for they will not only provide materials for the ſloping bank, but will alſo intercept the little rills, and land ſprings, which, in their courſe towards the river, might cut and tear up the banks or glacis.—Theſe trenches ſhould always be carried as far as the banks, particularly when theſe laſt are intended to fence off a riſing tide; and in the loweſt part of the ground, a ſluice with a valve, flap-door, or flood-gate ſhould be placed in the bank, to diſcharge the inland water, when the tide is out.

It is almoſt needleſs to add, that the ſeaſon of the year freeſt from floods ſhould be choſen, for making theſe banks, in order that the ground may have time to become firm and ſolid before the heavy rains fall.

The tops of theſe banks, next to the trench, ſhould have a ſmall flat, which might be formed into a footpath. This would ſerve as a convenience, and would at the ſame time help to conſolidate the made-ground; and, on account of ſafety, the trench ſhould be dug three or four feet at leaſt from the bank; ſo that a perſon falling in the dark might not ſlip into the trench.

In the Iſle of Ely, which is very flat, it is common to ſee great banks, diſtant one or two hundred yards on each ſide from the channel of the river; and when they are ſo made, with ſuch ſpace for the ſtream, they are always ſafe: but when the diſtance between the banks is too confined, there they are in danger of being broken down, and the country overflowed.

Lord Limerick recovered between four and five hundred acres of very rich ſalt marſh, at Dundalk in Ireland, and ſecured them from the ſea, by ſuch banks as theſe; and by ſuch as theſe alſo, many hundred thouſand acres have been recovered from the ſea in Cambridgeſhire, Lincolnſhire, and other parts of England; not to mention the low lands of Holland, which are indeed ſecured againſt the ſea by no other means.

It ſometimes happens, that the ſea flows through a narrow paſſage, by which the inland waters are diſcharged, and then extends itſelf, and covers a great deal of ground. When this happens, and the inland waters cannot be diverted into another courſe; let a ſtrong ſluice be fixed in the loweſt part of the channel, properly conſtructed with ſtone piers, and a ſtrong foundation of flint ſtones, or wood, for the water to run over. When this is done, then form the ſloping bank on each ſide, as before deſcribed, of ſand, or any other ſoil near at hand.

By firſt fixing the ſluice, the ſea will have a wider ſpace left to flow through, than if the banks were formed before the ſluice was built. For the ſame reaſon, the banks ſhould be begun at the lower part of the channel, and from thence be carried upwards.

If, by any accident, the waters ſhould ſwell, and overflow, ſo as to tear the banks; further miſchief may be prevented by fixing with all expedition a ſail cloth, or ſheet of linen, at the bottom of the bank, where the flood breaks in; for if this be done in time, the water will flow over the linen, without waſhing away the bank.

In every improvement, the expence ſhould be particularly conſidered. That of making banks in this method, is very ſmall. In low grounds, the ſoil is ſoft, and dug with eaſe; and the materials are on the ſpot. All the charge will often be more than repaid, by the firſt year's improved crop of graſs, and the ſafety of the meadows. The produce of ſucceeding years will amount much higher; and the huſbandman will be out of danger of having his lands overflowed and ſpoilt in future.

Farmers have often ſuſtained more damage from the hay deſtroyed in one ſeaſon, by floods, than the value of what it would have coſt them to incloſe and embank their meadows.

Although I have here obſerved, that all embankment, along which waters have to flow, ſhould be kept as ſmooth as poſſible; yet there are ſome occaſions where the courſe of a ſtream is to be turned by a dam, or dyke, formed for that purpoſe: then it may be uſeful to retain the mud and filth of the river itſelf, ſo as they may accumulate and increaſe the dyke, both in bulk and ſtrength. In ſuch caſes, it will be highly expedient to make uſe of furze, in the compoſition of the wall or dam. If the wall, or dam, is meant to fence off a paſſing ſtream, lay the buſhy tops of the furze towards the water, fixing the ſtems down into the wall, or dyke, by ſtakes, and mould over them, to prevent their being waſhed away. The conſtruction of ſuch dams muſt be begun from the bottom, and care muſt be taken to give them a gentle ſlope upwards, as before directed for earth banks. The bruſhy tops being waſhed by the paſſing ſtream, they will gradually retain the mud, and filth, yielding to the waters as they flow; but, at the ſame time, combing them, as it were, of all their groſſer matters, by means of their ſmall, thick, and thorny foliage.

But if this ſort of dam is meant to form a head, or wall, acroſs a running ſtream, then obſerve to place the ſtems of the furze upwards, that is, towards the current, ſtaking them down, and covering them with mould as before, and leaving the bruſhy tops down the ſtream, to form the ſlope or fall of the water.

ARTICLE III.

Of the Improvement of Moors, Bogs, or Moſſes.

I SHALL begin with thoſe lands, which are commonly diſtinguiſhed by the appellation of Moors. The firſt thing to be done with them is, to divide them into proper incloſures, with ditches and hedges; not only to ſecure their future produce, but alſo to be the means of procuring rich earth to lay over the exhauſted and feeble ſoil on the ſurface, to mend the ſtaple by giving it freſh vigour from the acceſſion of new mould, and to give room to thoſe plants which may hereafter be cultivated, to ſpread their roots and fibres with advantage.

Then, as the natural produce of this land is of no value, its ſurface ſhould be pared off, in order to be burnt. But as the ſubject of burning earth will be fully treated of in the next ſection, I ſhall only obſerve here, that the huſbandman ſhould be careful not to make his clods too dry, the aſhes being the better for the clods having ſome moiſture; and care ſhould alſo be taken, to prevent thoſe fires from ſpreading wider than what may be ſafe or convenient.

If the depth of the mooriſh earth be not very conſiderable, the ſurrounding ditches which make the incloſure will afford a rich ſtrong ſoil, which ſhould be ſpread two or three inches thick all over the ſurface. If the ditches ſhould not afford a ſufficient quantity, they ſhould be made wider on purpoſe. If no proper mould can be got from them, ſand or gravel may be uſed with ſucceſs; as was practiſed by the ancients*. Gravel is ſingularly beneficial to ſuch lands; as I ſhall have occaſion to mention more particularly. When the clods are burnt, their aſhes ſhould be mixed with the new ſoil that is ſpread over the field.

The Berne Society, who recommend this method of improvement, as founded on repeated experience, very properly obſerve, that the good effects of ſand and gravel will be conſiderably increaſed, by a moderate mixture of dung, eſpecially if the ground be intended for plowing. This covering ſhould be a hand's breadth in thickneſs. Dung alone would undoubtedly be extremely efficacious on all ſuch ſoils, in which it is remarked to be of longer ſervice than in any other; but the farmer can ſeldom ſpare a ſufficient quantity of it, to go far enough unmixed, nor indeed for mixing. Other ingredients muſt therefore be recurred to: though the ſand and gravel will generally do great things without any mixture. Well-preſerved wood or coal aſhes, will be of excellent ſervice; ſo will ſoap aſhes, the rubbiſh of old buildings, or any other ſimilar ſubſtance, when mixed with the ſand and gravel, even of the coarſer kind, and incorporated with this naturally rich earth; which, were its real value known, and the proper method of treating it rightly underſtood, might claim a preference before any other ſoil. Loam is ſtill better than either ſand or gravel. This ſhould be laid on the ſurface of the moor, over the aſhes of the burnt ſods: or, if not too expenſive, the loam and aſhes might be mixed firſt, and then ſpread over the field. Lime, where it can be had, if properly mixed with the loam, or ſand and gravel, will alſo contribute much to the meliorating of moor or moſſy grounds. The mooriſh earth thus covered, is fitted for various kinds of crops, of which I ſhall ſoon have occaſion to take further notice.

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* Virg. Georg. l. 113.

Mr. King obſerved, that wherever a little mould or gravel was accidentally laid, it became a green ſod, covered with a fine ſcutch graſs; and doubts not but the ſame expence that ſands or gravels moor land, would bring a dried bog to be arable.

The advantage of covering drained bogs with earth, is taken from a fact that happened to Mr. Græme, near Stirling, in Scotland. Two years after he had earthed over his bog, which he had not yet ſowed, it was as full of the natural white clover and other graſs, as any field generally is in twice that time.

In the province of Groningen, they pare off the ſurface of the ſoil, which is a light looſe earth, and lay it by, till they have dug out the peat underneath, when they mix it with the ſand which lies under the peat, and ſow it with rye, and hay ſeed the firſt year; after which they let it run to graſs, and have ſurpriſingly fine crops. In Sweden, a drained bog was remarkably improved by a peaſant, who burnt upon it a parcel of uſeleſs wood and lime-ſtones; and another converted his drained bog into a fine meadow, by covering it with lime, and tanners bark.

But the moſt perfect, and moſt laſting, improvement of bogs, is certainly effected by paring off their whole ſurface, and burning it, like that of mooriſh ground. To this end, they ſhould be levelled, and whatever earth remains unemployed in filling up hollows, ſhould be burnt, with that taken out of the ditches; unleſs the latter has already been carried off for fuel. The greater the quantity of aſhes, the greater will be the improvement of the ſoil, and the more will the earth brought upon it be benefited. The fire on the ſurface of the bog, or moſs, exhales much of the bituminous acid of this ſoil; and the fixt alkaline ſalts, always found in ſome proportion in the aſhes, correct, or neutralize it, ſo that no inconvenience ariſes from it afterwards, if the ground be kept dry, as it ought to be. The fire ſhould not be allowed to burn fierce, but ſhould be ſmothered from time to time with freſh matter. When the bog is pared, and the clods are collected to dry, the farmer muſt prepare earth to cover the ſurface. Marle, which is often found under bogs, preſents the beſt covering that can be deſired. If a clay lies under the bog, it muſt be prepared before it is ſpread, as will be directed in the making of compoſts; though, in this caſe, no great quantity of dung will be required; as the aſhes, and the bog itſelf, will greatly aſſiſt in opening the body of the clay.

If a loamy earth be near at hand, it will perhaps be leſs expenſive to the farmer, to bring ſuch earth to cover the bog, than to dig and prepare the clay. Of whatever kind the earth be, which is laid upon the bog, the quantity ſhould be ſufficient to cover its whole ſurface three, four, or five inches deep, according to the quality of the ſoil brought. But, in general, it may be obſerved, that the deeper the mould is, it will form the deeper ſtaple when mixed with the boggy ſoil, and ſo be better adapted to the raiſing of grain, particularly wheat, which requires a deep ſtaple.

As ſoon as the ſurface is burnt, the aſhes ſhould be ſpread, and the covering of mould laid over them: then the land will be fit for the culture, either of corn, or graſs. If the bog be of great extent, it may be expedient to have a ſluice, upon the outlet of the main drain, by means of which the water may be raiſed in the ditches; and both the manure and produce of the land may then be conveyed in flat-bottomed boats. This would ſave expence in carriage, and prevent deep ruts in a tender ſoil. But if land carriage is neceſſary, it is almoſt needleſs to ſay, that broad wheels are far better than narrow, for ſuch lands.

The bog thus prepared, the huſbandman muſt next determine, to what purpoſes he can beſt apply it. It is uſual to begin with ſowing ſome ſort of grain on this prepared ſurface, to indemnify the farmer by the plentiful crop which it generally yields; ſuch, indeed, as ſometimes defrays at once the whole expence of the improvement. Perhaps the moſt profitable may be, to ſow it in the autumn with rape, the leaves of which, ſhading the ſurface in hot weather, and rotting in winter, contribute greatly to mellow the earth. The ſtrong roots of this plant open the ſoil; its aſhes enrich it when burnt, and its ſeed brings a large return, when ſold for making oil. One or two plowings will then prepare it for a crop of wheat. After the rape is off, and the ſtubble burnt, or plowed in, it may be immediately ſowed with turnips, or planted with cabbages, which in the ſpring may be ſucceeded with barley, and with it the graſs ſeeds from upland paſtures, and white clover, may be ſowed, and the whole be thus laid down for a laſting meadow.

The ſhorteſt way of improving bog, or moſs, if the ſituation admits of it, and if it is only intended for graſs, is, when drained, and burnt, to level the ſurface; then put a ſluice on the main drain, and from that and the other drains, throw the water over it frequently in the winter. The mud which the water leaves behind, will bring a fine ſwerd upon it in two or three years, and be afterwards an annual manure. The graſs will then bear cutting yearly, and will, when cut, be good paſture for cattle. Care ſhould be taken, however, not to let the water remain too long on the ground; as it may be apt to chill, and thereby hurt the plant.

When, from choice, or for want of other arable land, the farmer intends to continue plowing his improved bog, the ſurface ſhould be raiſed in ridges; the manner of doing which will be deſcribed in the general directions for plowing; and the further management will be like that of other plowed ground. But I muſt not omit to mention, that the ſmaller croſs-drains might make the plowing extremely inconvenient, unleſs they are covered over; to effect which, ſtones muſt be thrown into them; over which put ſods with the ſwerd downwards, or ſmall faggots, or ſtraw, or broom, or fern, or whatever elſe can be had at leaſt expence, and then fill them in with the neareſt ſoil; obſerving to have one foot and half deep, at leaſt, over the faggots, ſtraw, &c. that the plough may not be interrupted in its courſe, nor the drain be diſturbed.

But if ſtones are not to be had, which may often be the caſe, there is then a neceſſity of managing the drains otherwiſe. For which purpoſe, take a narrow ſpade, with which make a cavity of its own width and depth, in the bottom of every drain. This new cavity made by the ſpade will be conſiderably narrower than the bottom of the old drain, and will conſequently leave a little flat ſpace, or ſhoulder, on each ſide of it. On this lay faggots, or bundles, of any of the articles above mentioned; the more durable the better. Theſe, being of a larger diameter than the opening of the new made cavity, will reſt upon the flat ſpaces, or ſhoulders, on each ſide, and leave the cavity open beneath, for conveying and draining the water; ſo that the ſpace over them, which formed the old drain, may be filled up to the level of the adjacent ground, and plowed over as before deſcribed.

But if a ſoil of this kind happens to be near a town, a greater profit will accrue from planting it with garden-ſtuff, than from any ſort of grain. Beans, peas, cabbages, potatoes, turnips, carrots, &c. thrive exceedingly well in ſuch ground as this. A ſtrong inſtance of this the Marquis of Turbilly gives in his improvements in Anjou. He ſowed ſome hard-cabbage ſeeds in a bed in his garden, and tranſplanted them from thence into a bog, which he had drained and cleared, pared and burnt. He ſpread the aſhes, without giving it any other manure: the whole did not exceed an acre of land, which was planted with the cabbage; and in one corner were a few carrots, parſneps, and beet-roots, which all grew to a prodigious ſize, and proved extremely good.

Some of the cabbages weighed forty pounds apiece, were well taſted, and very wholeſome; though the country people had prejudices againſt them, from their being raiſed in a new drained bog. Theſe cabbages, being carried to market, ſold for thirty-ſeven pounds, three ſhillings, and nine pence: and after deducting wages, carriage, and other expences, the marquis reckoned he cleared a profit upon this acre of eighteen pounds, twelve ſhillings, and ten pence. It was afterwards ſowed with hemp, peas, and ſeveral other plants, which anſwered extremely well, though none were ſo profitable as the firſt. The marquis further obſerves, that all the other bogs he drained and cleared on his eſtate, had proved very advantageous, but none of them equal to this, in proportion; which he attributes to a ſuperior fertility in the ſoil.

In a letter publiſhed by the Dublin Society, there are ſome new ideas upon the culture of bogs, which deſerve our attention. Red bogs, ſays the writer, are juſtly eſteemed the worſt. Black bogs yield ſome kind of paſture. They are, beſides, more eaſily reclaimable; and, when burnt, afford a large quantity of red, heavy aſhes, ſtrongly impregnated with ſalts: whereas the red bog bears no graſs, and, when burnt, yields very little aſhes; and even that little, of a poor, inſipid, and inferior quality.

Notwithſtanding theſe diſadvantages, the author of this letter had reclaimed ſome of theſe red bogs, and had even converted them to the very profitable uſe of hop-grounds; for accompliſhing of which, he gives the following directions.

Drain and level your bog in the manner already deſcribed: keep the water two feet deep in all your main drains, by means of a ſluice: this will ſerve for watering your ground in a dry ſummer, and will alſo afford a good manure of the mud and ſludge that will accumulate in the bottom of the drains. There is no danger, ſays he, that the land will be kept too moiſt by the water remaining in this ſurrounding canal.

At four feet from this ſurrounding ditch, draw another equi-diſtant, two feet wide, and two deep: fill it with the neareſt ſoil, and plant in it ſallows, or any other aquaticks fit for poles. They will thrive here exceedingly, and, with proper care, in ſix years time will be ready for the uſe of the hop-yard.

The earth about them is kept moiſt by the bog, and their roots are preſerved from froſts and winds by the diſtance of their ſtand from the edge of the main drain; ſo that nothing can prevent their growth: to forward which, ſtrip off the ſide ſhoots, when tender, which might otherwiſe impair the body of the tree; and throw up the mud out of the trench upon their roots, to ſupply them with freſh nouriſhment. This ſhould be done when the ſallows are two years old: at which time, and in ſummer, open the ſluice, and leave the drain dry. The mud at bottom will then harden, and may be eaſily thrown out.

When the bog is thus prepared, divide it regularly by lines, and mark the hop-hills at nine feet diſtance each way, by driving down ſtakes. At every ſtake, dig a hole three feet diameter, and three feet deep. Fill theſe holes with proper earth, or compoſt, to receive the hop-ſets, which are afterwards to be managed as in other places. It is obvious, that a conſiderable quantity of earth will be wanted, to fill the holes. To do this at the cheapeſt rate, is a matter of much importance to the farmer. Our author's method is this:

In the upland neareſt to the bog, he takes off the ſwerd of a ſmall plot, with the winged plough: having burnt it, he mixes the aſhes with the mould by thorough plowing; adding a little lime, rotten dung, or rich garden mould, and throwing the whole together into heaps, where it heats and rots, and, in a little time, affords the richeſt compoſt, and the beſt ſoil for hops. He ſays, that he has made artificial earths in this manner, not only for the preſent purpoſe, but alſo in other improvements; and found them, on trial, much leſs expenſive than they appeared to be at firſt view. The carriage to the bog is certainly the heavieſt article; though this is much alleviated by the width of the alleys, and the paſſage for carriages left between the holes.

Notwithſtanding theſe precautions, the letter-writer confeſſes this improvement is expenſive: but raiſing hops in any ground is ſo; and perhaps greater in the moſt favorable upland ſituations, than in a bog. A very little arithmetic will ſhew, that in ditching and incloſing a bog, the turf, or peat made, being equal to the charge; the plowing, harrowing, fallowing, and digging, which in this method are entirely ſaved, with the additional articles of dunging, hoeing, and paring the alleys in uplands; are more than equivalent to all the labour and expence attendant on bog hops: and from fifteen years experience he can venture to affirm, that the produce from the latter is as great in quantity, and in quality as good. Many reaſons may be given, why it ſhould be ſo; ſome of which are mentioned in the letter.

The care taken in uplands, to hoe and pare the alleys, ſhews that it is eſteemed a diſadvantage to have graſs growing among hops: red bogs are, by their nature, free from this inconvenience, at leaſt for many years, till the ſurface is altered.

Watering of hop-grounds in dry ſeaſons, though, from the great expence, too much neglected, is certainly of great benefit to the crop. This may be done in bogs, with great conveniency and little charge. The planter is readily ſupplied from the ſurrounding drain: and whoever underſtands the culture, and growth of hops, will reckon this no ſmall advantage.

Hop-planters agree, that low grounds are greatly preferable: they are leſs expoſed to drought, and ſheltered from ſtorms by their ſituation. Beſides, bogs enjoy other advantages, peculiar to themſelves: they do not ſuffer ſo much as other flats, by the rains of a wet ſeaſon, or the mildews of a dry one. Perhaps their ſpungineſs affords a paſſage to the waters, which lodge on other grounds; and their conſtant moiſture prevents the bad effects of too much heat. But what is more remarkable, they are free from thoſe ſwarms of inſects, which often infeſt our upland hops.

The roots too have liberty to ſhoot, as far as nature requires. They have firſt, three feet of the richeſt ſoil to go through, before they run into the bog; and even there, when it has been well drained, they will meet with better juices, than in a cold ſtiff clay, or a ſharp ſour gravel, which are the bottoms of upland grounds. The poles will ſtand as firm here, as in other land: the earth laid into the holes being preſſed together, and confined by the tough ſtringy ſubſtance of the bog, will ſupport them ſufficiently, without ſinking them any deeper than in other hop-grounds. The ſucceſs of this culture in grounds commonly deemed barren, ſhews what may be done with lands leſs ungrateful.

Before I diſmiſs this ſubject, I muſt lay before my reader the very uſeful obſervations I have met with, in ſome papers upon the ſucceſsful improvements lately made, by planting in ſwampy and boggy ſoils. I have indeed mentioned before, that ſuch land might be advantageouſly planted with oſiers, willows, and alders: but if more uſeful trees can be raiſed there, with ſucceſs, it increaſes the utility of ſuch land; eſpecially in thoſe ſituations where draining would be attended with much difficulty and expence.

Mr. Fletcher, of Northleach in Glouceſterſhire, who has had great experience in the planting of foreſt trees, aſſures us, that no land whatever is ſo proper for the growth of aſh, in particular, as ſwampy, ruſhy, and boggy ſoils. He ſays, he has planted aſh on land that was ſo boggy and rotten, that the men were obliged to ſtand on boards, to prevent their being mired; and which, from its ſituation, could never be drained, ſo as to render it fit for the cultivation of corn or graſſes. It was, continues he, aſtoniſhing to ſee their growth. Facts can be eaſily produced, to prove that ſuch land, not worth a ſhilling an acre, for any other purpoſe, has, in divers places, produced in thirteen or fourteen years, from ſixty to ſeventy pounds worth of the fineſt aſh poles, at a moderate price; beſides leaving a proper quantity of oaks, &c. ſown with them, for maiden timber. Where labour is not very dear, an acre of ſuch land may be planted with four thouſand five hundred aſh ſets, which are a proper number, for eleven or twelve pounds.

A ſmall expence of weeding, and pruning, will ariſe for two or three years after planting; but then it is over: and he thinks, no method of cultivation can poſſibly prove ſo advantageous on boggy ſoils.

It has been, however, juſtly obſerved, that in Mr. Fletcher's eſtimate of the expence of planting, he has omitted the very material one of fencing from cattle; which cannot amount to leſs than eight pounds more an acre, added to the above twelve pounds.

Another account of the ſame kind is given by Mr. Rack, late ſecretary to the Bath Society; and is thus related.

In the county of Eſſex he remarked a very fine plantation of aſh trees, on a piece of moor land, which was worth little for any other purpoſe. The ſoil was a black boggy moor, and had formerly been a hop-ground; but ſo wet, that it would not anſwer for that, or any other purpoſe in agriculture, although it had been cut acroſs with many open drains, five feet deep, to take off the water. The extent was three ſtatute acres; and the following is the account of the planting and produce.

" In the year 1764, the above three acres were planted with ſmall ſeedling aſh plants, drawn from my wood hedges, and waſte grounds, at four feet diſtance from each other. When they had ſtood two years, they were cut down within four inches of the ground. They were then left to grow ten years, and produced as follows:

31 cwt. poles ſold on the premiſes for....	£39	6
11 load of fire-wood ſold alſo on premiſes for	8	16
	£48	2

" The other acre and an half is ſtill ſtanding, and much ſuperior to that already cut.

" On examining the ſtanding part of the plantation, it appeared to be in the moſt healthy and vigorous ſtate. The ſhoots were generally three in each root, ſtraight and clean; the bark being clear, ſmooth, and of a fine blueiſh green. The annual ſhoots were frequently from three to four feet in length; and from their preſent appearance, if cut next ſpring, will exceed the former part, in value, at leaſt one third.

"The young ſhoots in that part, cut in 1776, are remarkably ſtrong, and healthy, and bid fair to be fit for a ſecond cutting in ſeven years."

By this eaſy and judicious management, one acre and an half of land, not worth five ſhillings a year for any other purpoſe, has paid the planter near fifty pounds in twelve years; and what remains to be cut next ſeaſon, will probably bring him full ſeventy pounds more.

The firſt five years after planting, they were kept clear from weeds; but that trouble and expence is ſince over: and in time to come, after deducting the ſmall charge of cutting, the whole produce may be reckoned clear gain.

In addition to theſe valuable pieces of information, I ſhall only ſay, that by the calculation of men of experience, it has been found, that the planter of ſuch lands may count upon a clear yearly gain of three pounds an acre; which is ſurely of itſelf ſufficient inducement to this uſeful and ornamental improvement.

If I have dwelt longer upon this article, than may have proved entertaining to many of my readers;

ers; I hope it will be ſome apology to ſay, that knowing how much of this ſort of land is yet uncultivated in Great Britain and Ireland, I have been the more diffuſe; wiſhing to give every information in my power, that may tend towards its improvement.

CLASS II.

Of Marſhes, and the Method of Draining and Improving them.

HAVING now treated very fully of the draining of bogs, the ſurface of which is mooriſh, or peat, earth; I ſhall here ſpeak more conciſely of draining and improving places which are covered with a more natural ſoil, but are ſo marſhy, that they cannot be turned either to arable, or good paſture land, till they have been drained.

The ſuperficial ſoil of marſhes, being compoſed of diſſolved vegetables, duſt blown in by the winds, and earth waſhed down from high grounds, with which they are generally ſurrounded, is often light and ſpungy, but very rich and valuable when drained.

Some plants require a greater, and ſome a leſſer proportion of water in their food. The plants uſually cultivated in our fields are of the latter kind, and are eaſily injured by an over proportion of moiſture. Hence water may be regarded as an impediment to vegetation; and it becomes neceſſary to conſider the moſt proper methods of conveying it off the land.

Where coarſe graſs is produced, the ground is evidently overcharged with moiſture, proceeding either from cold ſour ſprings, loaded with ſome mineral, or acid, which want vent; or elſe from external floods, which, being confined by a ſtiff clay, impervious to water, remain upon it, and corrupt the natural nouriſhment, proper for producing the ſweet and richer graſſes. When this laſt is the caſe, the remedy is eaſy; by making drains fit to carry off the ſuperfluous moiſture. But if the land be ſpouty, or ſpewy, as it is commonly termed, and the moiſture ariſes from ſprings, a deep drain muſt be cut in the loweſt part, and ſmaller drains, from that principal ditch, to ſuch places as appear to be the heads of the ſprings; which will be known by their being wetter and looſer than other parts. The drains muſt be cut deep enough to reach the bed through which the water flows, whether gravel or ſand; and upon the firſt touching of this, the water will be found to run off more freely, and in greater quantity.

The ſmaller drains communicating with the main ditch, ſhould be left open for ſome time, until the quantity of moiſture abate. After this, to make them covered drains, by which the ſurface is rendered level, and no part of it is loſt, they ſhould be filled with ſtones as before directed, (page 74), through which the water will paſs with eaſe, the drains will prove effectual, and the plough will go freely over them without meeting any oppoſition. A foot deep of mould over the drains, will be ſufficient in paſture lands; but in arable land, one foot and a half is required. As I have already mentioned the alternative of faggots, and the beſt mode of uſing them, I will only further obſerve, that the main drain ſhould be kept open, in order that it may more eaſily diſcharge the water, without any danger of its being choaked up; in which caſe the whole work would prove worſe than uſeleſs.

The beſt time for covering theſe drains is about Michaelmas; becauſe the earth is drieſt at that ſeaſon. The digging in marſhes is laborious work, as the under ſtrata are commonly tough: it is therefore neceſſary to mention what appears the eaſieſt method, which is, by opening the drain three ſpades wide, making the next depth only two ſpades, and the bottom only one ſpade wide; which laſt ſpade ſhould be narrow enough to admit of its being eaſily covered with faggots, &c.

and if the mould of the drain is tender, pieces of branches might be cut, of about eighteen inches long, and laid acroſs the drain at proper diſtances to ſupport the faggots.

There are ſeveral inventions of drain-ploughs, which are intended both to facilitate and expedite the draining of land, and conſequently to reduce the expence. Mr. Young, in his Eaſtern Tour, gives a deſcription and plate of one invented by Mr. Arbuthnot, which he uſed with great ſucceſs; but confeſſes at the ſame time, that it was too complex, and too expenſive, for him to recommend it to the public.

There is a model of another drain-plough, in the Repoſitory of the Society of Arts in the Adelphi, which I like better, though it performs leſs work. It however takes out a ſpace of ſixteen inches wide at top, twelve wide at bottom, and ten or twelve inches deep. This excavation is certainly not ſufficient for a covered drain, but is a good preparation for one. The next operation ſhould be performed, as before directed, with a ſpade, at the bottom of this firſt trench; and then a ſmall ſpade, or ſcoop, will complete the work, by making a ſufficient channel for the water, at the bottom of the ſecond cavity; which channel is what ſhould be covered over as above deſcribed.

This,

This, however, can only be performed on land that will bear the treading of cattle.

Where the ground in which the ſprings are, or where the wetneſs is occaſioned by climate, or a rainy ſeaſon, lies on a gentle declivity, Mr. Tull very properly adviſes plowing it ſo as to give the furrows a gentle fall, juſt ſufficient to carry off the water that would otherwiſe ſink into the adjoining ridge. This gentle current of the water would alſo prevent its waſhing away the lighter and richer mould from the higher parts of the field; an effect extremely common on ſloping grounds.

This idea of Mr. Tull's, however, though it may be ſucceſsfully purſued in grounds which have one uniform declivity, yet will not anſwer where they are waved, or undulated. When this is the caſe, the beſt farmers in my neighbourhood plow their lands directly up and down the ſlope, and lay the ridges high, making from ſpace to ſpace large water furrows right acroſs the ridges, and interſecting the other furrows at right angles, by which means all the furrows between the ridges become drains; the water that falls on the ridges, making its way to the furrows, is by them conveyed to the ſmall croſs-drains, or waſte furrows; theſe break the current, and receive the water from the common furrows, with which they communicate, and alſo lodge the fine ſoil which would otherwiſe be carried to the bottom of the declivity. The plowed lands on theſe declivities are ſo apt to be waſhed by heavy rains, and ſo much of the finer ſoil is thus moved downward, that, in this part of the country, we generally prefer open drains; on that account, and leſt the moving of the mould ſhould occaſion a ſtagnation in covered ones. The former, indeed, require to be renewed every ſeaſon: but they are far leſs expenſive than the latter; being firſt formed by the plough, and afterwards cleared out and widened with the ſpade.

Bogs are certainly fitter for meadow, than arable land: but a clayey marſh, when drained, turns to better account when arable, than in meadow. This is perhaps the caſe in all clayey ſoils, which, when not too ſtiff, produce excellent crops of corn. If their tenacity be too great, they muſt be treated in the manner directed for ſtiff ſoils. It is found by experience, that gravel, lime, calcareous and ſhell marle, and other ſubſtances of a ſimilar nature, kill the coarſe aquatic plants in a clayey marſh, after it has been perfectly drained; and ſoon cover its ſurface with a good ſwerd of fine ſweet graſs.

It is a good method, when the water is well drained, to pare off the ruſhes, flags, &c. which may be laid in heaps to rot, and will afford a good manure. The ground muſt alſo be plowed, to deſtroy the roots of noxious plants and weeds; and if it be laid fallow for one ſeaſon, and plowed two or three times, it will mend the land greatly. The ruſhes and flags which were pared off, ſhould, when rotted, be ſpread over the ſurface, and the graſs ſeed be ſown thereon. This will greatly forward the graſs; ſo that it may ſoon be brought to a good turf, or ſwerd.

Others, after having pared off the flags, ruſhes, &c. lay them in ſmall heaps, and burn them in dry weather; then ſpread the aſhes on the land, to improve it. They would do better, however, to burn their weeds in large heaps; beginning with a ſmall fire at firſt, and feeding it gradually as the flame burſts out: for this would confine the ſmoke and ſalts of the vegetables. For the ſame reaſon alſo, it is proper to obſerve, that vegetables burnt when full of ſap, produce moſt ſalts. Great heaps have another advantage over ſmall ones, for in them the fire is not ſo eaſily extinguiſhed by rain.

But where the expence can be afforded, I would recommend burning, not only the ruſhes and flags, &c. of ſuch land, but likewiſe the ſurface itſelf upon which they grow; paring it with a winged plough, or a breaſt plough, and then burning the turf in large heaps, where the roots of the weeds will increaſe their value, and facilitate the operation.

CLASS III.

Of Wood Lands, with the Method of Clearing and Improving them.

IN ſome countries, ſuch, for inſtance, as moſt parts of America, where there are ſo much wood, and unoccupied land, that neither is much valued, or bears a great price, people ſeldom take the trouble of cutting down the wood; but, when they want to convert a piece of wood-land into arable, they ſet fire to the coarſe graſs, withered leaves, and under-wood, as ſoon as they are dry in the ſpring. This fire generally catches hold of the trees, and at the ſame time deſtroys them: for if it does not totally burn them, it at leaſt ſcorches them ſo that they die: and after this the peaſant is rarely at the pains of felling them, but lets them ſtand till they rot and drop of their own accord; which creates a great deal of extraordinary labour, in the plowing, or other improvement of the ground. But in places where timber is ſcarce, great care is taken to preſerve it; the ſtumps of trees are grubbed up, and a profit is found even in digging up their roots.

I have been informed from good authority, though I have never experienced the fact, that hot lime laid on the root of a tree which has been felled, will, in a ſhort ſpace of time, ſo diſſolve and corrode it, that it may be cut up and deſtroyed with little labour.

When the roots are very large, and obſtinately tenacious, M. de Turbilly's advice is, to blow them up with gunpowder.

Peter Sommer, a peaſant in the canton of Berne, invented two machines for removing trees themſelves, and alſo their roots. The former of theſe, for rooting up trees, was tried in the preſence of the chief magiſtrates of Berne, in a wood near that city; where it pulled up an oak, three feet eight inches diameter, towards the bottom, with all its roots, in eight minutes time; though the ground had been conſtantly frozen, for near two months. It was alſo tried with ſimilar ſucceſs by a committee of the London Society for the Encouragement of Arts, Manufactures, and Commerce; in whoſe repoſitory a model of this machine is preſerved.

Mr. Evelyn has likewiſe given us in his Sylva, page 24, a very ſimple machine for pulling up large roots.

The late Captain Bentinck, of the Royal Navy, invented alſo a moſt powerful engine for this purpoſe; which, upon trial, ſucceeded wonderfully well, as I have been informed by men of character, who were eye-witneſſes of its operation. The machine was made in London; but I find no model of it in the repoſitory of the Society: otherwiſe I ſhould take pleaſure in deſcribing it, and in doing juſtice to the memory of its ingenious inventor; with whom I had the honor of being acquainted.

Where a place has been overgrown with wood, the earth is ſo thoroughly ſtirred by digging, and pulling up the ſtumps of the trees, that one plowing in autumn is generally ſufficient. The froſts in winter kill the weeds, and break the clods; and after a ſecond plowing in the ſpring, theſe lands will bring an abundant crop: for the trees not having exhauſted the earth towards the ſurface, but on the contrary having manured it with their leaves, a conſiderable produce may be expected for many years.

M. du Hamel mentions a ſmall field, which had formerly been under-wood, and being converted into arable ground, produced plentiful crops of wheat and oats for twenty years running, without being manured or ſummer fallowed. It is true, the ſoil was peculiarly proper for wheat, and would have been exhauſted much ſooner, if it had been a poorer earth.

CLASS IV.

Of common Heaths and waſte Lands, with the Method of Breaking up and Improving them.

THESE lands, which are by far the moſt extenſive ſpecies of uncultivated land, yet remain to be treated of. In my progreſs through this part of my work, I ſhall have frequent recourſe to a little tract, extremely entertaining and well written by the Marquis of Turbilly, a French nobleman, who, with great ſpirit and enterpriſe, improved his paternal eſtate, in the province of Anjou, and ſet an example in his native country, which, if generally followed, would ſoon have made France a much too formidable rival for this little ſeat of attention and induſtry. The many barren and uncultivated ſpots ſtill remaining in almoſt every part of this kingdom, not even excepting the moſt fertile counties, call for further exertions of that induſtry which has already diſtinguiſhed us, and has enabled us to lift up our heads and ſtand undiſmayed againſt a world in arms!

In thoſe parts of the country, which are indeed too few, where oxen are uſed for plowing, it may be a matter of conſiderable utility, to mention an obſervation of the marquis, relative to the manner of feeding them. He ſays, that in the beginning of winter, he gave them hay mixed with an equal quantity of rye-ſtraw. This ſucceeded to his wiſh: his oxen continued in perfect health, free from vermin, to which they had before been ſubject, and in better plight than thoſe in his neighbourhood, which were fed with hay and wheat-ſtraw. He ever after continued to give them this food, as long as they lay within doors, and found it anſwer extremely well. During this time, they had no corn, even though at work; and it is ſingular to ſay, that he did not find, his ſuppreſſing their uſual allowance of oats, rendered them at all leſs hearty or vigorous; which he attributed to ſome ſuperior quality in the rye ſtraw.

He proceeds to inform us, that great part of the land which he had to improve, was covered with heath, broom, and furze, which had grown very thick and high. In the ſpring, when the weather was dry, he ſet fire to the ſurface, after taking due precautions to hinder the flames from ſpreading too far. The whole burnt very well, and he was in hopes of being able to plow up this land, without paring off the turf. This would have been a conſiderable ſaving; eſpecially as the aſhes were already ſpread. Ploughs ſtronger than uſual were made on purpoſe for this work: but the roots of the furze and broom, which had reſiſted the fire, broke them; and though the number of cattle for draught were doubled, yet ſeveral of the oxen were ruined by this hard labour, which was perſiſted in with too much obſtinacy. In vain was it plowed over and over, and every clod broken, both before and after ſowing it; the broom and furze were not deſtroyed, but made new ſhoots every where: the land continued unkindly and ſour; and the oats ſowed in it ſcarcely yielded any crop. In ſhort, repeated plowings and dungings were neceſſary during three years, before it could be brought to a good tilth, or thoſe noxious plants be quite extirpated.

This unſuceeſsful experiment, ſays M. de Turbilly, raiſed the laugh of the whole country, at his expence; eſpecially of thoſe who had foretold from the beginning, that he would not ſucceed.

The following year, having the ſame ſort of land to deal with, he took care to avoid his former error. Each day's cutting of the heath, broom, &c. was burnt, and the whole ſurface was dug by hand, as it was cleared. By theſe means, the aſhes of the plants preſerved their fertilizing quality, and their roots were pulled up. Women and children ſhook the earth from the roots and turned them, whilſt they were drying in the hot weather.

Theſe were alſo laid in heaps from ſpace to ſpace, and burnt upon the ſpot, where they yielded ſome aſhes, which were ſpread, and immediately buried with one turn of the plough.

Here I muſt interrupt the marquis's narrative, to repeat an obſervation made before, that the aſhes of his roots would have been much better, if he had not dried them before they were burnt. When his fires of broom and furze were well lit, he ſhould then have laid on the green roots, and ſmothered the flames, wherever they broke out, with freſh ſupplies of furze, &c. This is the only way to have aſhes ſtrongly impregnated with ſalts; for, by a curious chemiſtry in nature, it is the vegetable acid in the plants that is converted by calcination into the alkaline ſalt.

I muſt alſo beg leave to make another remark in this place; that the marquis does not ſeem to have known the great utility of quick-lime, in improving theſe waſte lands; the ſituation in which, I will venture to ſay, it can be of moſt uſe as a manure: for its powerfully diſſolving and fermenting quality, would have rendered every fibre and root left in the ground, of real advantage: firſt, by converting them into a manure; ſecondly, by preventing their again putting forth freſh ſhoots; and, thirdly, by ſweetening the ſoil, abſorbing the acids, killing the inſects, and correcting the crudities, by fermentation.

It is true, he tells us that he did not diſcover a lime-ſtone in his own ground, till ſome years after: but after he had diſcovered it, he ſeems, from his own account, not to have been aware of its vaſt utility, in his operations.

The marquis continues to relate, that he plowed the above-mentioned land ſeveral times during the ſummer, and each time in a different direction from the former. His cattle were little fatigued with this work; the heath, and broom, &c. were almoſt entirely deſtroyed; and the ſourneſs of the land was in a great meaſure cured. He then made compoſts, which were mixed with ſtall and ſtable dung, and proved of ſingular benefit. With their help, he was enabled to manure his newly broken up land ſufficiently; that is to ſay, to lay upon it half the quantity that is generally uſed of dung, for the common run of lands. This he ſowed with rye, which yielded a plentiful crop. The crops from his former improvements, which he continued to take without reſting them, were alſo good and plentiful.

Moſt of his yet uncultivated lands had been, from time immemorial, thick covered with high broom, heath, fern, furze, &c. and experience, ſays the marquis, had now taught him, that ſuch lands were not to be broken up with the plough alone. The method which he ſeemed to prefer was, a paring mattock, and burning. Being ſhort of hands for his other buſineſs, he let this to ſtrangers by the piece: but they deceived him, having only ſkimmed off the ſurface, without hardly touching the roots of the plants, which they ſhould have cut up. When the turf they had cut was dry, and burnt, the ſmall quantity of aſhes it produced, made the marquis ſuſpect the roguery: and this was fully confirmed, by ſome of the ploughs being broken by the roots in the ground. The wheat ſowed in this, roſe, indeed, pretty well, and looked tolerably during part of the winter; but not being able afterwards to ſtrike through the cruſt, formed by the remaining matted roots of the plants, moſt of it died, and the little that ſurvived ſcarcely returned the ſeed: nor could this land be recovered till the next year, even by plowing, breaking the clods, and dunging.

The next year, M. de Turbilly did not agree by the piece, for breaking up his land, leſt he ſhould have been again deceived; but hired labourers by the day. He himſelf took particular care to ſee, that they cut deep enough to go under the cruſt, or net-work, formed by the roots beneath the ſurface.

When the turf thus pared, to the thickneſs of about four inches, was dried, piled up, and burnt in heaps from ſpace to ſpace upon the ground, it yielded a conſiderable quantity of aſhes, which enriched the ſoil for a long time. Wheat was then ſowed, and the plough eaſily turned up the furrow, which covered the ſeed. Women and children broke the clods of this ground, which was thereby brought at once into good order; the roots of all the wild plants having been effectually cut through, and their ſeeds deſtroyed by the fire. The wheat, by theſe means unincumbered with noxious productions of any kind, flouriſhed well, and yielded an excellent crop.

The following year, the ſame method being again purſued, ſucceeded as well as the former; and having now dunged the new land with half the quantity commonly uſed upon ground, it was found to produce much more than before. The marquis relates an inſtance of the increaſe of corn, which, for its ſingularity, I muſt not omit to mention. A grain of barley had accidentally dropped in the ſowing ſeaſon, upon an old dead ant-hill, in a heathy ground, about two feet diſtant from the edge of one of his improvements. This ant-hill was then a perfectly fine mould, formed of the rotten particles of what the ants had formerly treaſured up there, and of thoſe inſects themſelves which had died. This grew, and put forth ſeveral ſhoots. Curious to ſee what this would come to, he had it fenced from the cattle. Having nothing near to obſtruct its growth, it continued to thrive, till it became a kind of little ſheaf. In July, when it was ripe, the marquis himſelf reaped it; and when it was taken out of ground, and the earth was ſhaken from the root, he plainly perceived the remaining huſk of the grain, from which all the ſtalks grew, and from whence all the roots were evidently derived. He then picked out the corn on a ſheet, and reckoned the produce, which amounted to one thouſand four hundred and forty grains of as large, fine, and ſound barley, as any he had ever ſeen. This, ſays the marquis, ſurpaſſes all the wonders we read, of the fertility of Judea and Egypt in ancient times.

M. de Turbilly now diſcovered lime-ſtone on his eſtate; which he mentions as very fortunate, both on account of his buildings, and as being productive, alſo, of excellent manure for his land.

The worſt lands, he ſays, are thoſe ſharp burning ſands, which are fit to make mortar: ſome are white, ſome yellowiſh, and others red. They are generally abandoned, as quite barren; but, ſays the marquis, there is no ſoil, however unpromiſing it may appear, but will produce, when rightly cultivated; and pay for the care and labour beſtowed on it.

Some of theſe ſandy ſoils, naturally yield nothing; others, only moſs, or ſhort heath, with here and there a few piles of graſs intermixed.

If their produce is not great, their culture is cheap. Water, ſtones, and roots, are ſeldom met with here. If nothing grows upon them, they may be croſs-plowed, and ſowed, as will be hereafter directed: if they produce ſhort heath, and tufts of graſs, theſe may be burnt as they ſtand: if the heath is ſo ſcattered, that the fire will not communicate; it will be eaſy to dig up the roots left by the plough, that they may be burnt. This ground ſhould be plowed the beginning of ſpring, in dry weather, with a common plough, having only the addition of a fin to the ſhare. A fortnight after this, it ſhould have a ſecond plowing acroſs; in order to deſtroy the roots of the coarſe graſs and ſhrubs. Women and children ſhould then collect all the roots and clods, that they may be burnt in heaps, as before directed; and after ſtrewing the aſhes, theſe ſhould be turned in by a third plowing. Soon after, the ground ſhould be harrowed with ſhort light harrows, then dreſſed with a manure ſuited to the ſoil, and afterwards ſowed with buck-wheat.

This grain ought not to be deſpiſed: it yields greatly, ſells well, and is very proper to fatten ſwine, or poultry. Even bread is made of it, in many parts. It is the beſt grain for this kind of ſands, in which it delights. The crop in autumn will amply repay the expence of breaking up this ground.

If it be not intended to ſow the land with any other kind of grain, the ſtubble of this may be plowed in, as ſoon as the crop is off the ground; and when manured, and properly plowed in the ſpring, it may be ſowed again with the ſame corn. The ſecond crop, which will be better than the firſt, will be a clear profit. This land, ſays the marquis, ſhould then be reſted a year. After which, it may be ſowed every alternate ſeaſon, in the ſame manner as before directed, with buck-wheat, which will thrive in it: and it is ſcarcely poſſible, from ſuch poor land, to obtain a tolerable income, at a leſs expence.

The term of reſting land, here uſed by the marquis, is extremely unphiloſophical; and appears as if he thought the earth, like an animal, could be fatigued by exertion. Land may, no doubt, be exhauſted by a ſeries of crops, and bad management: but, if properly cropped, well dreſſed and managed, it will require no reſt; nay, will be improved by continual labour. Neither can I at all reconcile myſelf to the plan of cropping, here laid down by the marquis. The ſecond crop of buckwheat I have no objection to, becauſe of the manure afforded by the ſtubble and roots; which help, alſo, to conſolidate the ſoil. But, as the land is propoſed to be dreſſed for this ſecond crop, I would proceed, without allowing it any reſt, to plow it the third year, and to ſow it with carrots; for, in ſuch a ſoil, thus prepared, I have no doubt of their ſucceſs. This being a hoeing crop, the land will be much meliorated; it will be cleaned, and laid up to the benign and fertilizing influence of the air. This crop may be ſucceeded by one of ſpring-tares, which, being drill-ſowed, will admit of ſummer hoeing: and it is to be obſerved, that in all very ſandy ſoils, hoeing is more beneficial than repeated plowings; for hoeing keeps the ſoil clean, without breaking too much its tenacity or coheſion; a quality much to be courted in ſuch ſoils.

Having thus got your land in good order by repeated hoeing and manuring, perhaps the very beſt way it could be employed, would be to lay it down with ſainfoin or burnet, drill-ſowed; both of which artificial graſſes, if kept clean, would anſwer well on ſo light a ſoil, and turn to good account.

If this land be intended for planting, there is no occaſion for dung at all; and after the firſt crop of buck-wheat, it may be planted as will be mentioned hereafter.

If this hungry ſand be deſtined always to bear corn, pulſe, or other crops; either becauſe land is ſcarce, or becauſe there is no better; or that it lies near ſome conſiderable town, or village, which makes it more valuable, and ſupplies it with manure; or from any other reaſon of profit, or pleaſure; it will then be neceſſary to give it a more laſting dreſſing.

For this purpoſe, dig holes at certain diſtances, till you reach a ſtrong rich earth, which is always found under ſand. Lay a ſufficient quantity of this earth, that is, about double the quantity generally uſed of marle for plowed land, over the ſurface of this ſandy ſoil, in little heaps near one another. The poorer the ſoil, the more heaps are required; and the holes being near, they may be laid on with wheel-barrows: after which, fill the holes with the ſand from the ſurface.

Sand being ſo eaſily dug, this may be done at no great expence. Let theſe heaps lie untouched all the winter, that they may be thus expoſed to the influence of the ſnows, froſt, ſun, air, and dews; after which they will pulverize like aſhes. They muſt then be ſpread over the land, which ſhould have a light plowing, to begin to mix them with the ſand. A deeper plowing ſhould be given a fortnight after; and ſo ſucceſſively, till this fat earth and the ſand are ſufficiently mixed. All plowings on ſuch ſoil ſhould be performed with a very light plough; a couple of heifers, or aſſes, will often ſuffice.

The land is then to be manured, as other lands are, and afterwards ſowed with rye in September, or October. The firſt crop from theſe ſands, thus managed, will be good; ſuch as nearly to pay all the expence of the improvement. The ſecond and third, for which no manure will be wanted, will be ſtill better, and more profitable; being attended with little expence. Theſe lands, ſo improved, with a large proportion of clay or marle, may be made fit to bring wheat.

M. de Turbilly ſays, he had twenty years experience of a piece of land, which he had thus improved; and found it anſwer his purpoſe well: but at the worſt, if this ground ſhould happen to fall off, and its crops be leſſened, the remedy is eaſy, by only laying on half the quantity that was uſed at firſt; by which the land would aſſume freſh vigour.

The marquis recommends ſtrongly for new improved lands, rye; which, though far leſs valuable than wheat, is raiſed with leſs trouble, yields well, is leſs liable to accidents, is more eaſily kept, and has many other well known good qualities. The bread made of it is very wholeſome: more than half the kingdom of France live upon it, either alone, or mixed with ſome other grain. Wheat-ſtraw is undoubtedly more valuable; but to thoſe who keep working oxen, the rye-ſtraw mixed with an equal quantity of hay, is a moſt excellent fodder, as was before obſerved.

It is of the greateſt advantage to the huſbandman, to know how to turn every part of his produce to uſe. Even the haulm, or ſtraw of buck-wheat, when threſhed, may be given to cows in the winter: they will eat it without injury; they will not grow leaner upon it, nor will it hurt their milk in quantity or quality.

The light ſandy and gravelly ſoils are certainly ſuperior to the former, but deſerve only the name of indifferent. They, however, abound more in France than any other. They are of various colours, and are more or leſs fertile, according as the bed of clay, marle, or rich earth, which always lies under them, is at a greater or leſs depth from the ſurface. Their natural produce is generally heath, ruſhes, fern, broom, furze, bramble, and ſuch like, intermixed with graſs. From the height, thickneſs, and vigour of this wild growth, one may always judge of the degree of goodneſs of the ſoil. This never deceives.

When ſuch ground is to be broken up, it will be right, during the winter, to get rid of the three principal obſtacles, water, ſtones, and large roots. About the middle of March, the paring of the ſurface ſhould be begun. It is done with a mattock formed like an adze, of good ſteel, and nine inches wide at the edge, from whence it diminiſhes gradually to the handle, which is fixed by being inſerted in a hole of two inches diameter in the uſual way; it ſhould be formed ſomewhat hollow, with a little bend inwards. This is the inſtrument deſcribed by M. de Turbilly, as always made uſe of by him for paring ſuch land as is here mentioned, where the thick interwoven matting of roots made it neceſſary to take off a turf of four inches thick at leaſt.

The late ingenious inventions of Engliſh farmers, and artiſts, for accompliſhing buſineſs of this kind with greater facility, and more expedition, by ploughs particularly conſtructed for the purpoſe, makes this paring inſtrument of little utility.

If, after the paring, or plowing of land like this, ſome ſtrong roots ſhould here and there remain, they may be dug up with a ſpade or pickaxe.

Mr. Worlidge obſerves, that the beſt, and cheapeſt method of grubbing up thorny ſhrubs, goſs, or ſuch like, is given us by Gab. Platt. This inſtrument recommended by him, is ſimply a three-grained dung-fork, only much larger and ſtronger, according to the ſize of the ſhrubs to be moved: the ſtale, or handle, like a large and ſtrong lever. This inſtrument, placed at a proper diſtance from the root of the ſhrub, and driven into the ground with a hedging-beatle, then raiſed by putting a log under it, and pulling down the upper end by a rope faſtened to it, will wrench up the whole buſh by the roots.

M. de Turbilly proceeds to obſerve, that though the ſpirit and warmth of the ſalt contained in the aſhes of land thus pared and burnt, will ſoon render the corn more forward than any other; yet as neither graſs, weed, nor wild productions will riſe amongſt it, their ſeeds having been deſtroyed by the fire, it will appear thin during the winter; but on the approach of ſpring, it will ſhoot up, ſpread, and tiller, ſo as often to become rather too thick. It always ripens about a fortnight ſooner than any other corn in the country. The fineſt is always found on the ſpots where the heaps were burnt; the effects of the fire having been greateſt there.

As the richneſs of this land depends moſtly on the aſhes; the more there is of them, the more it will be fertilized, and their effect continue longer. But all kinds of ſoils do not furniſh an equal quantity of aſhes. When ſandy, vitrification naturally takes place, and prevents calcination. Thoſe which calcine moſt, are undoubtedly the beſt: and ſmall trials will ſoon aſcertain what may be expected from the whole. The heaps, however, which are moſt burnt, or burn the faſteſt, are not the beſt; for aſhes may be too much conſumed, and their goodneſs diminiſhed. Much finer corn has grown, where the outſide turfs of the heaps were burnt ſlowly, were calcined only, but remained ſo entire, that it was neceſſary to break them, before the ground could be ſown. In general, thoſe heaps which produce white aſhes are inferior both in quantity and quality.

The huſbandman ſhould begin to ſpread his aſhes, in the manner before directed, about Midſummer, as ſoon as the heaps are cooled; without leaving any in the places where thoſe heaps were burnt. Immediately after, a ſlight plowing ſhould be given, juſt ſufficient to bury the aſhes; no more of which ſhould be ſpread, than the plough can cover in the ſame day.

A few days after the firſt, a ſecond plowing ſhould be given, ſomewhat deeper in the ſame direction; and theſe plowings ſhould be continued, each going a little deeper than the former, till the ground be looſened to a ſufficient depth. Two croſs-plowings will then be of excellent ſervice: after which, a fifth acroſs them will bring the furrows to their firſt direction. The ground ſhould be harrowed ſeveral times between all theſe plowings, with harrows proportioned to the ſtrength of the ſoil; and if any clods have reſiſted the tines of the harrow, women and children ſhould be employed to break them; it being neceſſary to pulverize the ſoil as much as poſſible.

Women and children will alſo clear away the ſtones that are turned up, at each ſucceſſive plowing, laying them in a convenient place for uſe. If there be any ſtones in the ground too heavy to be moved or loaded in carts, they muſt be broken with ſledges, or blown up with gun-powder. A few days before the land is ſown, it ſhould have another ſlight plowing; after which, throw in half the uſual quantity of ſeed, and harrow it well. Drains or water-furrows ſhould then be cut, in the manner before directed, as ſoon as poſſible, to carry off the water in winter. If any great clods ſhould ſtill remain, they muſt be broken. It is needleſs to ſay, that care ought to be taken of the quality of the ſeed. The nature of the ſoil muſt determine what grain it will be moſt proper to ſow. In general, unleſs the ſoil be very excellent, rye appears to be moſt adviſeable for the firſt crop; and from the ſucceſs of this, the farmer will be able to judge what his land is fit for next, without running any riſk.

As ſoon as the ground is cleared, a light plowing ſhould be given, to bury the ſtubble and turn up the ſoil to the air: after which, the ſame courſe of plowing, harrowing, ſtoning, and rooting, muſt be repeated for the next year's crop, as was for that of the former year. All theſe plowings and harrowings will pulverize the earth, and mix it equally with the aſhes.

A little more ſeeds may be ſown the ſecond year; about one third leſs than is uſual, will do.

If this ground is meant to be planted, ſtill it is better in that caſe, to take three, four, or even five crops from it before hand.

This will not injure the young plantation, but will break and prepare the ground for it, and will repay the expence of culture. The firſt crop will not be the beſt; on the contrary, it will often be but indifferent, the ground not being yet brought to a ſufficient tilth. However, it will always repay the greateſt part, if not the whole, of the expence of breaking up the land. The ſecond crop will be much better, and bring more profit. The third will alſo be good; and ſo indeed will the following, if the ſoil be fertile.

If the land thus broken up and tilled be intended always to produce corn, and is not ſufficiently enriched by a great quantity of aſhes; it muſt in that caſe be manured the ſecond year, before it be ſown in the manner above directed. A moderate dreſſing will do; that is, about as much as is commonly given to other land. Experience will ſoon ſhew the advantage of manuring this land the ſecond year; notwithſtanding the opinion of thoſe who pretend, that new land is always rich enough of itſelf.

The lands thus brought into tillage, by the means of burning, become infinitely better than other grounds, and produce much greater crops. This proceſs improves the ſoil for upwards of twenty years. No weeds will ſpring up amongſt the corn, for a conſiderable time. The vegetable food in the earth is therefore not waſted here upon uſeleſs plants, but ſerves entirely to nouriſh the corn, which accordingly ſhoots with redoubled vigour, produces well filled ears, without the trouble or expence of weeding it; and, when thraſhed, is ſo clean, that it needs only to be winnowed. The bread made of it is excellent, and of a ſuperior quality.

Worn-out meadows, ſays the marquis, which he has reſtored by the ſame means, and ſowed anew with graſs ſeeds, have yielded great quantities of excellent hay.

A worn-out meadow is to me, however, a very unintelligible expreſſion. If by worn-out is meant, a meadow that does not produce abundantly, it ought to be well dreſſed with a proper compoſt; if that does not do, give it a good dry dreſſing of mould and ſoaper's aſhes. If, for want of care, the ſwerd has become thin, ſcabby, and moſſy, ſow it with good graſs ſeeds, with which mix a proportion of burnet, in the month of March, after the above-mentioned dreſſing; and when the ground is moiſt, run ſtrong thin tine harrows over it; and in the month of April, or May, buſh-harrow, and roll it. Such a ſimple, and unexpenſive proceſs, I am convinced, will ſave the tedious, and coſtly one, propoſed by the marquis.

But to return: ſtrong, fat, clayey ſoils, have an advantage over the former, in being fit to bear repeated crops of wheat. The breaking up of ſuch lands is however attended with ſomewhat more expence than the two former kinds. Their natural produce is little different from that of other ſoils; and the three obſtacles, water, ſtones, and great roots, common to all uncultivated lands, muſt firſt be removed, before any other improvement can take place. The future operations on this ſoil, are almoſt a repetition of what has been recommended for the two former. One great advantage attending theſe ſtrong lands is, that they calcine well; they alſo burn ſlower than the former, and afford a much greater quantity of aſhes, which increaſes their fertility.

There are, however, ſome ſoils of this kind, which produce ſo few weeds or other wild productions, that it is not poſſible to take off ſods ſufficiently furniſhed with plants, to make them burn. When ſuch lands are to be brought into tillage, inſtead of paring and burning them, they ſhould be dug and broken in the ſpring with the ſpade and pick-axe, and be left to dry for a month or ſix weeks; after which, women and children may be employed to break the turfy clods, and ſhake the mould from their roots. Theſe roots ſhould be well dried, then laid in heaps from ſpace to ſpace, where they are to be burnt; and their aſhes, after being ſpread with ſhovels, ſhould be plowed in as ſoon as poſſible, with a one-finned plough. Several other plowings ſhould then be given ſucceſſively, during the heats of ſummer, with the ſame plough, croſs ways, ſlanting, and in every other direction. Between the plowings, women and children ſhould break the clods.

I muſt

I muſt again beg leave to make a remark upon theſe laſt directions of the marquis. For, as theſe directions relate to lands that have *few weeds or other wild productions*; why ſhould they be dug in the ſame expenſive manner as thoſe which have a cloſe matting of interwoven roots?

For my own part, I ſhould not heſitate to employ the plough in this buſineſs; and after plowing and croſs plowing, and harrowing and plowing again, I would collect thoſe clods that were not broken, but probably tied together by roots of graſs, or couch, or ſuch like, and theſe I would burn, as before mentioned. Indeed I have actually done this on a ſimilar occaſion, where the clods turned up by the plough were ſo bound together by the roots of couch graſs, (triticum repens) &c. that I could not break them with ploughs or harrows, and therefore had recourſe to fire, with great ſucceſs.

The uſual time for ſowing other lands will anſwer for this: but it might be ſafer and more ſucceſsful to begin ſuch land with a crop of oats, rather than rye or wheat; for it will not have the ſame proportion of rich aſhes as that formerly deſcribed, nor will it be ſo clear of weeds or inſects; and oats, being of a more hardy nature, will force their way with greater certainty.

As ſoon as theſe oats are cut, the ground ſhould be plowed, and croſs-plowed, ſeveral ways, and ſeveral times, during the remaining dry weather, in order to break and looſen it. It ſhould then be manured, either with dung or a compoſt; or, if there be occaſion, with marle, lime, or other things of the like nature.

Here, for the firſt time, M. de Turbilly mentions the uſe of lime, on this ſort of land; a manure far exceeding all others for this purpoſe, for reaſons I have already mentioned.

The marquis concludes his diſſertation on this ſubject, with ſaying, that he by no means approves of breaking up uncultivated land with the plough only, without having previouſly prepared it in ſome of the ways here directed; unleſs it be in the caſe of very light ſandy ſoils, which are not ſo fit for paring or burning.

In all other trials with the plough only, he had no reaſon to be ſatisfied with his ſucceſs; nor can it ever anſwer, but in places where there are no weeds or wild plants. Thoſe, ſays he, who take this method, as the leaſt expenſive, will find in the end, that they have ſaved nothing, and often run the riſk of being loſers by it.

Having thus ſelected every intereſting circumſtance from M. de Turbilly's account of his improvements, I ſhall now lay before my readers a ſhort, but maſterly ſketch, from an Engliſh practitioner, upon the ſame ſubject*.

Our author informs us, that, one year he broke up ten acres of heathy land, which had long been a ſheep-walk, and produced little elſe than furze, heath, and mole-hill thyme. The ſoil was a looſe, ſandy, blackiſh gravel, and in general very dry. In March it was turned over with a whelming plough, about ten inches deep; a pair of heavy harrows were then run over it, to get out the roots of the furze, heath, and other trumpery. Theſe were burnt, and the aſhes ſpread. In May it was plowed acroſs with the ſame plough, harrowed, the weeds burnt, and the aſhes ſpread as before. In July it was again plowed, and thirty buſhels of lime, per acre, ſpread over it. In September it was plowed a fourth time, harrowed, and the rubbiſh burnt. By this time it was in fine tilth. In October, half of it was ſowed with wheat, and half with rye; the former nine pecks, and the latter three buſhels per acre: the winter proving favorable, the rye came up thick, and grew winter-proud. In January, a herdle-fence was run acroſs, and ſheep were turned in to feed it off. They remained there till the end of February, and left the field almoſt bare. It was then top-dreſſed with ſix buſhels of lime, per acre, which made the crop ſpring vigorouſly. It was a very fine crop, and yielded near five quarters an acre.

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* Tranſactions of the Bath Society, Vol. I. p. 120.

The wheat did not ſpring ſo ſtrong as was expected, but thickened towards ſpring, and produced near four quarters per acre. Both crops were clean.

The year following, ſix acres more of the ſame ſort of land were broken up, and treated in the ſame manner, till June; when they were ſown with turnips. They came up very well, and eſcaped the fly. They had two good hoeings, leaving the plants fifteen inches apart. The crop proved very good in quality, but the turnips were rather ſmall.

At Michaelmas, beaſts and ſheep were turned in; and in ſix weeks fed them off. The land was very clean; and the manure left by the cattle had ſo enriched it, that it was judged no great riſk to ſow it with wheat. It had a good plowing, was ſowed with the wheat under furrow, and harrowed down.

It came up well, and the crop turned out near four quarters per acre. In the autumn, twelve loads of clay were laid on this land: and in January, after the froſt had broken the clay, ſo as to make it mix eaſily with the ſoil, it was plowed in with the ſtubble. In March, it was plowed acroſs. In April, it was plowed a third time, and harrowed fine: it was then ſowed with ten pecks per acre of Zealand barley. Two weeks after ſowing the barley, three pounds of Dutch clover were thrown over it*. Both the clover and barley ſoon made a fine appearance: the latter yielded five quarters per acre, and the former was a good thick plant at Michaelmas.

In the ſpring following, it was dreſſed with forty buſhels per acre of ſoaper's aſhes; and in the ſummer it was twice mowed. The firſt cutting was upwards of two tons, the latter about twenty-five hundred weight, an acre. It was then broken up for wheat, and produced an excellent crop the ſummer following.

The lime, clay, and aſhes, had doubtleſs their ſhare in producing theſe crops: but the writer of this account ſeems to attribute his ſucceſs chiefly to the repeated plowings, and burning of the rubbiſh. This land, ſays he, which was not worth five ſhillings when firſt broken up, is now worth twenty-five ſhillings per acre.

An obſervation naturally ſuggeſts itſelf in the peruſal of this account: that the furze, heath, &c. were not of that age, or ſtrength, as what

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* This is a very ſmall quantity of clover ſeed; I always allow eight pounds per acre: ſome of my neighbours ſow fourteen or fifteen pounds, which is abſurd.

M. de Turbilly ſeems to have had to encounter with; nor could there be that thick texture of interwoven roots, which made ſo formidable a reſiſtance in all his attempts to plow. It is, however, highly probable, that ſuch a plough as is here mentioned, was infinitely better conſtructed for this work, than any employed by the marquis. But even ſuppoſing this, I am clearly of opinion, that the buſineſs would have been more effectually done, by burning the whole ſurface, as turned up by the plough; rather than by burning only the rubbiſh collected by the harrows: therefore, after fully conſidering all the advantages which the marquis has ſtated, I ſhould be ſtrongly inclined to follow this part of his practice.

One part of our Engliſh farmer's method I muſt take notice of, as it accords perfectly with my own idea; that is, the manuring the new-plowed land with lime. In this, however, he commits an error, by allowing the lime to lie ſome time on the land before he plows it in. For as the great advantage of the lime, thus applied, is derived from its cauſtic, diſſolvent, and fermenting qualities, it cannot poſſibly be uſed too hot from the kiln.

I will now give an abſtract of the opinion and practice of another farmer, on the ſame ſubject, who has compared the benefits ariſing to the land from burning, and from liming; and has given a decided preference to the latter. He ſpeaks particularly of the improvements made on Mendip hills; where, he ſays, the ſpirit of cultivating theſe waſtes ſeems to overcome every obſtacle: and as a knowledge of the inefficacy of burning, may prevent much uſeleſs expence, hints drawn from real experience may be of ſome utility.

Having ſelected a field in which there was no apparent variation of ſoil, and, as it was a new incloſure, and had never been plowed, the furze, fern, &c. with which it abounded, added to the turf, furniſhed more than three hundred buſhels of very fine aſhes. The field being equally divided, the three hundred buſhels of aſhes were ſpread on one half, and four hundred buſhels of lime on the other half. The whole was ſowed with wheat in one day.

On the coming up of the wheat, it was attentively obſerved: the limed part aſſumed the moſt lively and healthy verdure; whilſt the other part appeared very weak, and languid; inſomuch that the difference was perceivable at a mile's diſtance. The limed part maintained its ſuperiority from that time to harveſt; and, on threſhing, it was found that the produce of this part was twenty-four buſhels, and that of the burnt part only fourteen buſhels, per acre. But this was not the only difference; for in leſs than a month after harveſt, the ſurface of the field where the aſhes had been applied, was entirely covered with young furze; while the other remained perfectly clean.

Here I beg leave to obſerve, that this little narrative is far from convincing me of the inutility of burning. It is certainly the firſt and beſt operation that can be performed on ſuch land as is here deſcribed: I have already recommended the liming, as that which ought next to be done. The narrator, therefore, would have done far better, to have ſpread his three hundred buſhels of aſhes, and four hundred of lime, over the whole field, inſtead of ſeparating them; and he would have found that they would mutually have aided each other, without danger of forcing the land too much.

We have now ſeen the French and Engliſh methods of accompliſhing this buſineſs: I ſhall next give a ſhort ſketch of the manner of doing it in Scotland. In that country too they ſeem to reject the plan of grubbing up, as tedious, and expenſive. They take therefore a ſtrong plough, with ſix horſes, two and two abreaſt: two plough-boys are neceſſary to keep the horſes to their draught in a direct line. As the furze, in riſing, is apt to entangle the ſhare and coulter, there muſt be a third perſon with a paddle, or pitchfork, to clear the plough. A plough thus tackled and attended, will plow down furze three feet high, with roots four feet long, and one inch diameter: but this operation can only be done, when the land is moiſt. After the land has been thus plowed, it ſhould be allowed to lie till ſummer, when the furze torn up by the plough, ſhould be burnt, the land harrowed, and the roots gathered. It may afterwards be dreſſed according to the judgment of the farmer. The ſecond plowing ſhould be acroſs, to tear up the remaining roots: but when the furze is ſo ſtrong, as to make it impoſſible to plow them down, they may be burnt; and if the land be allowed to lie a few years after, it may be plowed without difficulty.

It is very ſingular, that both the Engliſh and Scotch practice ſeems to be, to plow down the furze, &c. rather than to burn them; which would be the eaſieſt way of removing ſo great an incumbrance, and would at the ſame time ſpread ſome good aſhes over the field, which would be immediately plowed in by the next operation. The ſame defect, in not burning the ſurface, ſeems alſo to be common to both countries; to which, I have already ſaid, I much prefer the method of M. de Turbilly.

The Scotch authors ſeem to conſider the treatment of different wild productions in ſeparate ways, as if they were not the growth of the ſame lands. They tell us, for inſtance, that the beſt way of deſtroying broom, is by cutting it cloſe to the ground, (for which they have a ſcythe made on purpoſe) when it will not recover, or put out freſh ſhoots; and that brambles muſt be grubbed up, as they have a wide ſpreading root, and thrive moſt in ſtony lands. But are not all theſe wild productions generally found in the ſame land, and ſhould they not conſequently be all treated in the ſame manner? Or, even if they be found ſeparately, ſtill let them be treated as before directed; for that will prove moſt effectual for the whole.

Before I leave this ſubject, I think it neceſſary to mention another mode of improving waſte land, of which I have not yet taken any notice, and that is, by planting. There are ſuch inſtances of remarkable improvements in this way, that it would be extremely inexcuſable to paſs over ſo intereſting a part of my ſubject.

In the county of Norfolk, about ſixty years ago, there were vaſt tracts of uncultivated land, then deemed barren. The weſtern part of it abounded with ſands of ſo light a texture, that they were carried about by every wind; and in many places, the ſands were ſo looſe, that no graſs could grow upon them. Art, and induſtry have now changed the face of this deſart; and moſt of theſe tracts are either planted, or rendered very good land, and ſheep walks.

About thirty years ſince, the ſides of many of the little ſand hills were ſown with the ſeeds of French furze; and when a wet ſeaſon followed, they ſucceeded very well, and grew ſo faſt, that once in three or four years they are cut for fuel, and ſell at a good price in the parts adjacent. This excited ſome public-ſpirited gentlemen, to attempt the planting of Scotch, and ſpruce firs, and other hardy foreſt trees. At firſt they found ſome difficulty, from the extreme looſeneſs of the ſand; but as there is in that part of the country, ſome white and yellow marle, at about three feet below the ſand, they very judiciouſly thought, that by incorporating it with the ſand, in the holes where the young trees were planted, they would inſure ſucceſs; nor were they diſappointed.

This method ſucceeded beyond expectation; the plantations throve exceedingly, and the roots ſoon reached below the ſand; after which they were out of danger. This excited to further attempts.

On the ſpots intended to raiſe new plantations, from ſeeds and acorns, a thick coat of clay and marle was laid; which after being rough ſpread, and lying a winter in that ſtate, was made fine, and plowed in, juſt before planting. By theſe means, the ſoil became fixed, and, in a little time, covered with graſs and herbage; ſo that there are now vaſt plantations of firs, oak, and foreſt trees, in the moſt healthy and vigorous ſtate, where, within a very few years back, ten acres of land would not have maintained a ſingle ſheep three months.

But the benefit of plantations, whether of ſhrubs, copſe, or trees, is not confined to the immediate advantage, or even the future value, of the wood: for, by annually ſhedding a great number of leaves, which the winds diſperſe, and the rains waſh into the ſoil, it is conſiderably improved; and, whenever ſuch copſes have been ſtubbed up, the ground, however unfruitful before planting, has thereby been ſo enriched, as to bear good crops for many years, without the help of manure.

Of all the improvements which a lover of his country would moſt wiſh to ſee take place, there is none which merits more encouragement than that of planting ſuch barren ſoils, and waſte lands. A principal cauſe of this improvement having made a ſlower progreſs than others is, that the firſt expence is conſiderable, and the profits, though certain, are remote. But at the ſame time, it is a vaſt inducement to ſuch improvements,

provements, to ſee large plantations flouriſhing, where the ſoil has been ſo perfectly ſandy, that there was not formerly a pile of graſs to be ſeen; and where, after being planted twenty years, there have been two thouſand trees on an acre, worth at leaſt one ſhilling each, as they ſtood. A few acres of ſuch land, ſo planted, becomes an eaſy proviſion for the younger children of a family.

There is yet another ſoil, which may be turned to good account by the ſame means; the ſloping ſides of barren, rocky hills, which cannot be plowed. In ſuch places, there are numerous little clefts, or fiſſures, in the rocks, filled with veins of earth to a conſiderable depth; which the roots of trees will follow, and find nouriſhment in. Many inſtances of this kind may be found in the counties of Somerſet, Glouceſter, and Dorſet. On the north ſlope of Mendip hills, in particular, in the moſt unfavorable ſituation, on a bed of rocks, expoſed to the bleak north and eaſt winds, we ſee beautiful woods of large extent. In theſe woods, although the timber is not large, the growth of the pollard trees, and copſe wood, muſt every twelve years bring in conſiderable ſums to the owners; although the land, for any other purpoſe, would not be worth one ſhilling an acre.

In planting barren mountainous ſituations, full of ſtone, no particular directions can be given, as to the number of trees per acre; for you muſt follow the veins of earth, where they are deepeſt: but, in general, plant as deep as you can; for this will beſt prevent the bad effects of tempeſtuous winds, by the interior parts being ſheltered. In theſe ſituations intermix Scotch firs, which will ſecure leſs hardy trees from the fury of the winds; eſpecially if a double row of them form the boundary. As the ſurfaces of ſuch places are craggy and uneven, be careful to plant your trees in the little hollows, for two reaſons; becauſe there is moſt earth and moiſture, and becauſe in theſe cavities the plants, when young, will be moſt ſheltered. Fear not to plant too thick; for, as the plants increaſe in ſize and hardineſs, you may thin them at pleaſure, and their wood will pay for the labour.

Your young plants ſhould be raiſed in a ſituation as ſimilar as poſſible to that where you intend they ſhould continue: for if they were tranſplanted from a rich, warm nurſery, it would prove their deſtruction. As there is ſeldom ſufficient depth of ſoil among the rocks, to receive long tap roots, theſe ſhould be cut off from the plants which have them, when they are firſt taken from the ſeed-bed and planted in the nurſery. By treating them in this manner, although their vigour will be checked for the firſt year or two, until they have put forth a number of lateral roots; they will afterwards recover their ſtrength, and prove equally thriving with others.

Theſe plantations may be made with beach, birch, oak, aſh, ſycamore, Scotch fir, larix, and black poplar; always obſerving to place the tendereſt trees in the leaſt expoſed ſituations, where they may be ſheltered from the north and eaſt winds. In places where the ſoil is very thin, raiſe little hillocks about the young plants: this will greatly encourage their growth. In ſuch bleak ſituations, plant as late in the ſpring as you can with ſafety. In April, the moſt ſtormy weather is over, and all the above-mentioned trees may ſafely be replanted at that time. But the nurſery ſhould always be near the ſpot intended to be planted; elſe the roots of the young trees will get dry, and the buds be rubbed off in carriage.

During the firſt three months after planting, they ſhould be frequently examined, and the earth made faſt about their roots; otherwiſe they will be looſened by the winds: but after that time, they will have put forth new ſhoots ſufficient to hold them ſecurely.

The upright Engliſh elm, and wich elm, may alſo properly be introduced in theſe ſituations; for they are hardy trees, and, when once rooted, grow well on rocky ſoils. The timber of the latter is valuable for naves of carriage-wheels, and boring for water-pipes.

If oaks, cheſnuts, beach, or indeed any other tree that ſheds its leaves in winter, grow crooked; make inciſions with the point of a knife from top to bottom, in the hollow part. This will occaſion the tree to increaſe in bulk more in thoſe parts than in any other; and by this ſimple eaſy method, many a crooked tree has been made to grow ſtraight.

In the above liſt, I have mentioned the larix, than which there is not a hardier, or more uſeful tree. It is a native of the Alps, and will flouriſh on our higheſt hills, and moſt expoſed ſituations: it is beautiful, both in form, in foliage, and in height; as it grows to ſeventy and eighty feet high, perfectly ſtraight. The wood of this tree grows very hard, when ſeaſoned; and is therefore much leſs combuſtible than either oak, or fir; and is reckoned more durable. It is valuable for many purpoſes in building; and its induration makes it leſs ſubject to the ravages of the dry rot. Moſt of the piles upon which the city of Venice is built, are of this timber; and thoſe which have been taken up, have remained ſound for many hundred years, nay are become as hard as iron. This quality may make it prove of great utility in ſhip-building. It has vaſt quickneſs of growth, and cannot be too much cultivated. I find in a treatiſe written on foreſt trees, by Mr. Boucher, of Edinburgh, many uſeful directions reſpecting the culture of this plant.

The Rev. Mr. Onley cultivated ſome Carolina poplars, which, in mooriſh wet land, grew to be worth a guinea each in twenty years. The ſtem of one of theſe meaſured fifteen inches in girth; the three arms, at two feet from the parent ſtem, ſix, ſeven, and eight inches apiece. This ſpecies, ſays Mr. Onley, is beſt ſuited to a boggy ſoil; and the Turin (Lombardy) poplar, to a moiſt gravelly one; two of which, in twelve years growth, meaſured in girth, five feet from the ground, nine inches; and full forty feet high to the top.

I will cloſe this with the account of an experiment by Mr. Arbuthnot, who planted ſome black poplars, eight feet aſunder, the ſize about one inch and a half diameter. At the end of nine years he meaſured two of them: No. I. the beſt, contained thirteen feet of timber, which would ſell at ten pence a foot; and the forks at the top would give three rails, worth, with the faggots, two ſhillings; in all, twelve ſhillings and ten pence. No. II. the worſt, twelve feet and a half of timber, and the top worth one ſhilling; in all, ten ſhillings and five pence. Average, eleven ſhillings and ſeven pence.

An acre, planted in ſquares of eight feet, would contain ſix hundred and eighty trees, which, at eleven ſhillings and ſeven pence, amount to £393 0 0

EXPENCES.

Suppoſe the trees bought or raiſed at three pence each	8	10	0
Planting	0	5	0
Filling vacancies by death (ſuppoſe fifty)	0	12	6
Fencing repairs	0	10	0
Nine years rent (ſuppoſe at thirty ſhillings	13	10	0
Total	23	7	6
Which deducted from the above ſum, leaves a profit of	369	12	6
Which is per acre, per annum	£41	1	4

No huſbandry, or gardening, in the world, ſays Mr. Young, will equal this vaſt profit. It is aſtoniſhing, that more plantations of ſuch quick-growing trees are not made. This ſoil is a black, rich, low ground, near water.

Some willows, planted at the ſame time, and diſtance, meaſured on an average, eighteen feet of timber, worth ſix pence per foot, and the tops one ſhilling and ſix pence.

Six hundred and eighty at ten ſhillings and ſixpence	£357	0	0
Expences, as above	23	7	6
Profit	333	12	6
Profit per acre, per annum	£37	1	4

In ſituations where poles ſell well, Mr. Arbuthnot obſerves, you may cut them every ſix years, and get an amazing price. He likewiſe remarks, that the body of the willow-tree rives into pales, which are admirable for fences, hardening in the air; and are nearly as durable as oak.

ESSAY II.

Of MANURES.

HAVING now treated very amply of ſoils, and the beſt manner of improving them; it is time I ſhould proceed to ſhew, by what means the ſoils may be enriched, and fertilized with manure, ſo as to bring the largeſt increaſe of good, ſtrong, and ſound grain.

Tull, led away by an overweening predilection for a favorite ſyſtem, ventured to maintain, that the complete pulverizing of the earth, by the plough, and the harrow, is all that is requiſite, for perfecting the growth, and vigour of plants. He was himſelf perſuaded, and endeavoured to perſuade others, that this alone would ſuffice, without the aid of any manure whatever; which, he contended, could only ſerve to divide the ſoil, and render it friable.

It is not my part, blindly to adopt, or reject, any ſyſtem; but to weigh its merit with impartiality.

The horſe-hoeing huſbandry, firſt introduced by Jethro Tull, will be a laſting monument to his fame. The pulverization of the ſoil is of the greateſt conſequence. It opens the earth, and makes every particle of it uſeful to vegetation. It allows the fibrous roots of plants to ſhoot, and collect their food. It conveys that food with facility, imbibing and imparting moiſture, without being endangered by receiving too much, or by retaining it too long. Stirring the ground alſo deſtroys the weeds, and expoſes freſh mould to the benign influence of the air; than which, there is not a more powerful fertilizer.*. All this may, with great truth, be ſaid of Mr. Tull's ſyſtem. But it does not follow from hence, that manures are of no other uſe than to divide the ſoil. Experience indeed, the ſureſt guide in all human affairs, affords us the moſt convincing proofs to the contrary. Manures laid upon meadow lands do not divide the ſoil, yet improve the crop, by imparting new pabulum to the plants. Plants in plowed land muſt derive the ſame, or greater benefit, from an increaſe of pabulum.

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* Amongſt the numberleſs advantages that attend a thorough plowing, and pulverization of the earth, one is, that if there be any poiſonous qualities in the ſoil, ariſing from metal, or ſulphur, you infallibly deſtroy them, by turning them up to the air. The ſecond is, that you open the way for the fibres of plants to go in queſt of their food.—Fordyce's Elements of Vegetation, Appendix, p. 8.

Rejecting therefore this untenable opinion of Mr. Tull's, with regard to manures, let us proceed to conſider their various qualities; the beſt means of procuring them with œconomy, and of employing them with advantage.

We know, ſays Evelyn, that the earth, without any artificial auxiliaries, is endued with a wonderful prolific virtue: but as this is liable to be loſt, or to decay, and never can be expected from ſome grounds, without helps; it is worth our while to conſider by what expedient the deſired effect of perpetuating its vigour may be beſt accompliſhed.

The means of giving and perpetuating this vigour, becomes therefore the ſubject of our farther enquiry: and the ſame author, in diſcuſſing this ſubject, ſeems clearly of opinion, that were ſalt-petre to be obtained in plenty, we ſhould need but little other compoſt to meliorate our land.—That is to ſay, were the earth always kept in a ſtate fit for collecting ſalt-petre, it would always be in a ſtate fit for the production of plants.

It is well known, that ſalt-petre or nitre is obtained from ſubſtances of a mixed nature. Its baſis is a calcareous earth, to which are added animal and vegetable ſubſtances, which come gradually into a putrid ſtate. All theſe being intimately mixed and moiſtened from time to time with urine, or ſtale, are frequently turned and expoſed to the influence of the air, from which this alkaline compoſt attracts a fluid acid, which compleats its nitrous quality, by neutralizing the alkali.

Whoever will carefully attend to this deſcription of nitrous earth, will, I believe, be convinced, that Mr. Evelyn was not perfectly right in his opinion, when he ſays, that this is the ſtate in which earth is fitteſt for the production of plants*. It is true, that in this earth we have all the ingredients requiſite for vegetation; but by allowing them to proceed from their mucilagenous to their ſaline ſtate, we have let them paſs from a nouriſhing to a forcing quality. If we conſider the infinite number of animal and vegetable bodies which are rendered volatile by putrefaction, and fly off into the air; the quantity of perſpirable matter from animals and vegetables, riſing alſo into the air; likewiſe the effects of the aërial acid, on ſuch ſubſtances, when mixed with the earth; we need no longer wonder at the efficacy which writers in all ages have aſcribed to the air, with reſpect to its quality of enriching the earth*.

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* Having for a particular purpoſe mixed ſome lime and black mould and dung, I had them frequently turned over, and expoſed to the air under a ſhed. This compoſt was alſo moiſtened from time to time with urine, ſtale, and hatter's liquor. After it had been ſo treated for two years, I accidentally put ſome into a large pot, in which I planted a myrtle. The plant grew and flouriſhed to ſuch a degree, that it attracted my curioſity; and on examining the earthen pan in which the pot was placed, I could obſerve ſomething like white cryſtals. This preſently explained the myſtery. I carried the cryſtals to a red hot coal, where they gave evident proof of their being real nitre, by an immediate deflagration. This rapid vegetation of the myrtle does not however prove, that the earth was in its moſt fertile ſtate; but the mucilage remaining was forced into vegetation by the ſalt, and tended to exhauſt the ſoil, which could only be preſerved by adding more animal or vegetable matter for the ſalt to act upon.

That the peculiar richneſs of ſoils is owing to the putrid or rotten particles mixed with them, is an opinion of long ſtanding. This is the putreſolum of Virgil, rotten, crumbling, or looſe earth; and that which Columella diſtinguiſhes by the appellation of pinguis et putris, fat and rotten, or fat, looſe, and crumbling; as the ſoil which yields the greateſt profit, with the leaſt labour and expence; becauſe it is naturally neareſt that ſtate which cultivation is intended to effect; for, to cultivate land, is nothing more than to *drain, clean, looſen, and manure* the earth.

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* All mephitic air or noxious vapours, in fact, are volatile alkalis, and are beſt and eaſieſt removed by acids. Hence the ſalutary effects of waſhing between decks with vinegar. Acids properly applied, are alſo the only effectual antidote to jail diſtempers, putrid fevers in barracks, and ſcurvy in ſhips, and in caſemates; or, in ſhort, for any contagious diſtempers ariſing from foul or ſtagnated air. But this diſcuſſion, however uſeful, and on which much might be ſaid, is quite foreign to my preſent purpoſe. Calcareous earths, when employed in ſuch caſes, act only as powerful abſorbents.

Every ſubſtance which promotes the growth of plants, is denominated a manure. I ſhall arrange theſe ſubſtances into the following claſſes.

1. All foſſil ſubſtances, in their natural ſtate, and as altered by fire, ſuch as lime, chalk, marle, earth, and ſhells; to which may be added the fixed alkaline ſalt of plants, procured by calcination, aſhes, ſoot, and ſugar-ſcum, &c.

2. All the various manures obtained from vegetables, either in their natural or putrid ſtate: ſuch are ſucculent plants plowed in, tanner's bark, all the parts of vegetables which gradually decay, their putrid ſubſtances, &c.

3. Animal manures; ſuch as fleſh, fiſh, blood, bones, dung, urine, hoofs, horns, wool, hair, feathers, rags, &c.

4. The proper mixture of theſe various ſubſtances, in compoſts, ſuited to the difference of ſoils.

ARTICLE

ARTICLE I.

Of Foſſil Subſtances, as Manures.

Though ſhells may more properly be deemed an animal, than a foſſil body, yet, as they burn to lime, and act in all other reſpects as a calcareous ſubſtance, they are generally reckoned in this claſs. Their uſe and application, together with that of ſand, has already been treated of ſufficiently. A very particular account has likewiſe been given of marle, in the improvement of ſand. Calcined earths might alſo be properly included here, but they have already been treated of very fully, under the article of commons or waſte lands; and for the uſe and advantage of burnt clay, although it has been before taken notice of, when ſpeaking of the melioration of *clayey lands*, I ſhall probably have occaſion to mention that ſubject more at large, under the head of *paſture lands*.

I ſhall now ſpeak of lime-ſtone and chalk, when burnt into lime. It is quite unneceſſary, and would become very tedious, for me to deſcribe the various conſtructions of kilns that have been uſed for the burning of lime. I ſhall therefore only mention what ſeems to me to be beſt; leaving to others to make what changes they pleaſe, either in the form, or materials. A lime-kiln is moſt conveniently ſituated by the ſide of a riſing bank; becauſe the top of the kiln being on a level with the bank, will make it more eaſy to feed with the lime-ſtone and fewel, in a wheel-barrow, as they are wanted. If there is no bank near, an artificial ramp will ſupply its place. The outſide form is beſt cylindrical, and this either of ſtone or brick: the inſide ſhould be lined with good hard bricks, or ſuch as can beſt reſiſt the continual force of the fire. Its inſide ſhape ſhould reſemble that of an egg, opened a little at both ends, and ſet upon the ſmalleſt. This form, thus contracted at top, creates a degree of reverberation, and ſaves firing. The ſmaller end, thus opened, will ſtand on the level of the ground. From this, on the ſame level, two apertures muſt be made, facing each other. They ſhould be ſmall where they open from the egg; but ſhould ſlope, or diverge wider both at the ſides and top, as they extend towards the outſide of the kiln. Theſe are for admitting the air which is neceſſary for ſupplying the fire; and alſo for admitting the lime-burner to approach with a drag and ſhovel to draw out the calcined lime. From the ground, within the kiln, riſes a ſmall building alſo of durable bricks, and of a wedge form, the ſloping ſides of which are towards the above-mentioned apertures. The uſe of this is to throw out the lime-ſtone as it is calcined, towards the apertures.

At the firſt lighting of the kiln, this wedge, or horſe as it is called, ſerves alſo to ſupport for a time, the ſtrata of fewel and of lime-ſtone.

The walls of the kiln being thick, on account of the force of the fire, and the opening at top being contracted, to preſerve the egg form, there will be a conſiderable flat ſpace of ſolid maſonry from the inſide diameter of the opening, to the outſide diameter of the kiln. Raiſe upon this a wall of fourteen or fifteen inches thick, perpendicular with the outſide wall of the kiln, and to the height of three or four feet, from whence draw it up in the ſhape of a glaſs-houſe, leaving, as in it, an opening at top. Four circular holes may alſo be left oppoſite to one another, with ſhutters for admitting, or excluding air, in order to regulate the draught. The kiln being finiſhed, the lime-burner begins to lay on at the bottom, and over the horſe, a parcel of furze or faggots; over this a layer of coals or other fuel; then a layer of lime-ſtone, and ſo on alternately, ending with a layer of fuel. The fire is then lit at the hole on each ſide: and when he thinks his lime ſufficiently calcined, he begins to draw at the bottom; and ſees from a ſmall portion the ſtate of the whole.

When the lime is enough done, the fuel is gradually exhauſted, and the lime at top ſubſides. The lime-burner ſhould then throw in a freſh ſupply of lime-ſtone, and next a freſh ſupply of fuel, then draw ſome at bottom, then ſupply at top as before, till the whole quantity required is calcined.

This is what is called a perpetual lime-kiln; and ſuch a kiln, I have ſeen in uſe for ſix months together, without being once extinguiſhed. At the ſame time, it is obvious, that ſuch a kiln may be let to extinguiſh at pleaſure; and it may alſo be uſeful to obſerve, that the part of the building riſing over the kiln like a glaſs-houſe, is not abſolutely neceſſary; for good lime may be burnt without it. But if, from motives of œconomy, this part of the building is not made, there ſhould at all events be a parapet raiſed in the ſame ſituation, three or four feet high, to keep off the flare of the wind, which might occaſion vitrification, inſtead of calcination; and beſides, ſuch a parapet would prevent accidents to the workmen, and ſerve to lay up againſt it, their fuel and lime-ſtone. In a kiln thus conſtructed, chalk will be ſufficiently calcined in leſs than twenty-four hours; lime-ſtone will take a conſiderably longer time. But all this depends ſo much on the nature of the fuel, and the proper management of the draught, that no general rule can be given. Ten buſhels of ſea-coal, or an hundred faggots of three feet length, will burn forty buſhels of chalk, which will yield thirty buſhels of unſlacked lime. In this part of the country, they uſe no coals, but employ cinders, brought from town, along with their wood: but I think this a piece of falſe œconomy; for the additional quantity of cinders required, and the extra carriage, would more than pay the difference on coals.

There is a way of increaſing fuel, which, though I have never applied it to lime-burning, I am well convinced, from other trials of it, might be employed to great advantage in this.

It is, to mix two-thirds of the ſmalleſt and fierceſt ſmithy coal, with one third of cinders: put to them as much ſtiff clay as will work the whole into a paſte. Mould them like bricks, of any convenient form, and ſize, and dry them under a ſhed: when dry, uſe a layer of them by turns, with the chalk, or lime-ſtone. They have a moſt ardent and glowing heat, without flame; and the aſhes from the clay-part of the compoſition would improve the lime as a manure.

Where chalk is ſcarce, the chalk-rubbiſh is ſometimes worked up into a kind of paſte, with water, and made into bricks, which are dried, and then burnt into lime. Were theſe mixed up with the ſmall coal and cinders, it would both ſerve to burn them much better, and alſo contribute greatly to the complete calcination of the other chalk in the kiln.

When the kiln is an open one, that is, without the glaſs-houſe form at top, it would be right in rain, or in high winds, to protect the ſurface by throwing ſome turf over it. Perhaps it may be alſo of uſe to mention, that all chalk, or lime-ſtone, ſhould be broken into pieces not larger than a man's fiſt, before they are thrown into the kiln. They ſhould not, however, be uſed too ſmall; for that would choak the fire, and prevent the draught of air.

All ſoft ſtones, of a tolerable cloſe texture, will burn to lime; as will alſo marble, ſlate, ſea-ſhells, corals, and flints: but this laſt requires a reverberatory furnace, becauſe it is otherwiſe apt to vitrify.

Chemiſts differ about the qualities of lime-ſtone; ſome alledging that chalk will burn into lime, as good as can be produced from the hardeſt lime-ſtone*. For my own part, I am convinced that well-burnt chalk, completely calcined by a white heat, and deprived of its acidulous gas, is nearly on an equality with the beſt lime from lime-ſtone, both for cement, and for manure; excepting only one property, peculiar to lime-ſtone, which renders the lime produced from it much fitter for ſetting ſtrongly in water. What this ſingular property ariſes from, is not an object of preſent diſcuſſion.

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* Lime-ſtones are very different in their qualities, as they have a greater or leſs proportion of calcareous earth in their compoſition.

All ſorts of lime-ſtone, or chalk, may be burnt with wood, coals, cinders, turf, furze, or fern, which make a fierce fire. The moſt certain way to know what ſtone is fit for making lime is, to drop upon it a little *aqua-fortis*, or ſpirit of ſea-ſalt. All ſtones on which the above, or any other ſtrong acids effervefce, are lime-ſtones, or will burn to lime; and the ſtronger the effervefcence, the fitter they are for it.

With reſpect to the uſe of lime as a manure, and the manner of applying it, I find myſelf under the neceſſity of differing from almoſt every author I have read on the ſubject. In order to aſcertain ſome rule for the application of this moſt uſeful foſſil, let us reconſider its properties.

Lime, by calcination, is diveſted of all its watery particles, and of its acidulous gas, to the amount of one third of its weight. If, therefore, it is taken in this ſtate, it is of a cauſtic, corroſive, diſſolving, and alkaline nature. From theſe qualities, it melts or diſſolves every animal, or vegetable ſubſtance it comes in contact with, converting them into a ſemi-ſaponaceous ſubſtance. It is alſo an eager abſorbent, and attracts every ſort of liquid that approaches it; air, water, acids, and oils, are greedily ſucked in by it. As ſoon as it is ſaturated with any of theſe, it falls into powder, and, in the proceſs of a few months, loſes almoſt all thoſe qualities I have juſt now mentioned, and returns once more into its former ſtate of chalk, or effete lime.

From this it muſt evidently appear, that whoever lets lime lie on his land, till it is ſlacked by the air, rain, and ſnow, might almoſt as well lay upon it pounded lime-ſtone, or chalk; both of which operating as calcareous earths, would do the land great ſervice, but they will not act as quick-lime: the expence of burning would therefore be, in a great meaſure, thrown away. Quick-lime impedes putrefaction: but if it really has good qualities as a manure; the greater the ſtrength and vigour of theſe qualities are, it will certainly effect its purpoſe, both better and ſooner. It therefore only remains to conſider, what that purpoſe is, which it is required to effect. If the ſoil to be improved be cold and ſluggiſh, and charged with animal and vegetable ſubſtances, in a crude ſtate, we ſhall be at no loſs to determine, that quick-lime is the beſt manure it can have.

I have already ſaid, it is cauſtic and corroſive, it is diſſolvent, it is alkaline, it is abſorbent. Its extreme heat, from the igneous particles it contains, and from its diſpoſition to ſlack, will ſoon create a ferment in any ſubſtance with which it is mixed: this makes it exceedingly uſeful in cold or ſluggiſh ſoils, whoſe vegetative powers require being ſtimulated. Its corroſive and diſſolvent qualities will reduce to a pulp, or ſaponaceous ſubſtance, whatever roots, vegetables, or inſects, it finds in its way: thereby converting them into the food of plants. By its alkaline and abſorbent nature, it will not only attract thoſe acids which float in the atmoſphere, but alſo the vitriolic acid that may be in the ſoil, either combined with clay, or with iron; in both which forms it is noxious to vegetation. By effervefcing with theſe acids, it divides the ſoil into ſmall particles, and makes it mouldy and mellow, and evidently in a ſtate of fermentation.

Such are the admirable qualities of quick-lime. But does it not follow from hence, that lime, in this perfect ſtate, muſt be uſed with a ſparing hand, and with great caution? Repeated dreſſings of ſo forcing a manure, which are always attended with a great expence, however near the lime-ſtone, and however cheap the fuel; have been known to exhauſt the ſoil to ſuch a degree, as to have reduced it to a mere caput mortuum, incapable of producing any crop whatever.

This, however, ſays nothing againſt the uſe of quick-lime. The ſafeſt and moſt ſalutary medicines improperly applied, or taken in too great quantities, may be converted into deadly poiſons. We muſt therefore ſeek, perfectly to underſtand the patient's caſe, before we can juſtly ſay in what quantity, or in what manner, the doſe ſhould be adminiſtered.

If the lime is ſtrong, with all its qualities in perfection, the ſmaller quantity will be required. To have it in its ſtrongeſt ſtate, it ſhould be ſlacked when firſt drawn from the kiln, that none of its fiery particles may be allowed to eſcape into the air, and that it may not abſorb from thence any moiſture: for this purpoſe, throw a handful of unſlacked lime into the caſk of water, with which the larger quantity from the kiln is to be ſlacked: this will diſlodge the fixable air from the water, and prevent that air from being again reſtored to the lime. In this ſtate, quick lime is moſt perfect and fitteſt for manure, for cement, or for medicine.

Wherever ground is newly brought under tillage, it is obvious, that no manure is near ſo proper

per for it as quick lime; for there it will operate powerfully in diſſolving roots and vegetables, and in fermenting and ſtimulating the inactive ſoil, clearing it of weeds and inſects, and abſorbing its acidities. On an acre of ſuch land, one hundred and ſixty buſhels may be ſpread with great ſafety, and plowed in with a ſhallow furrow: for it will waſh downward. A ſmaller quantity, ſixty or eighty buſhels, may alſo be uſed on a clover lay; and ſhould be ſpread immediately before the turf or flag is turned over. Here it will meet with abundance of vegetable ſubſtance to operate upon; and will have excellent effects upon the ſucceeding crop of wheat.

I have already mentioned the good effects of quick-lime in improving of bog or moor-land; but in this, as in every caſe where it is uſed, I would certainly recommend a dreſſing of dung to ſucceed it: for by this good management, it will have freſh matter to operate upon; by which means it will further improve, and never can exhauſt, the ſoil.

But where there is too little native matter in the ſoil, for the quick-lime to work upon, it is far the beſt, and ſafeſt way, to diminiſh its ſtrength by mixture: and I can ſay with truth, that there is nothing, with which it can be mixed, but what it will improve for the purpoſe of manuring.

It is worthy of obſervation, that, without exactly knowing the real nature of quick-lime, but from repeated experience, farmers have now become cautious about the uſe of it, in moſt parts of Great-Britain.

Mr. Evelyn adviſed mixing the quick-lime with the turf, or ſwerd, laying them alternately, turf on lime, and lime on turf, in heaps, for ſix months; by which means, they would become ſo rich and mellow, as to diſſolve and run like aſhes, and carry a much more cheriſhing vigour, than if uſed alone in a greater quantity; and without danger of exhauſting the vegetative virtue it ſhould preſerve*. It is alſo greatly bettered for being mixed with dung, or with mud drawn from the bottoms of ponds, or rivers. In Weſtmoreland they reap fine crops of barley from their ſandy lands, by manuring them with quick-lime and cow-dung mixed.

In Shropſhire, they lay dung and lime together; about twenty loads of the former, and only twenty buſhels of the latter, on an acre: but this is running

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[*] This method is particularly uſeful, in preparing the ſoil or mould that is dug and ſtocked up in brows and hedge-rows; where, from the mixture of roots, weeds, and undecayed leaves, it requires being ripened and fermented, to augment its fertilizing powers: as I ſhall have occaſion to mention more at large hereafter.

ning to an oppoſite extreme; for they might ſafely give their land three times that quantity. In Leiceſterſhire, they ſow the lime on wheat land, when they ſow the wheat; but on barley land, the laſt earth but one, leſt it ſhould burn the barley, if ſowed with it, in the ſpring. They allow five quarters to an acre, reckoning by the meaſure in which it comes from the kiln; for after it is ſlacked, thoſe five quarters will make nearly ten.

Lime is thought to make corn grow with a thin huſk. It is eaſy to conceive, from what has been already ſaid, that it muſt be a great deſtroyer of moſs and ruſhes, as alſo of the remnants of furze, heath, and broom, after the old buſhes have been grubbed up.

In ſome parts of this country, they top-dreſs an acre of wheat with twenty buſhels of ſlacked lime, and four or five buſhels of ſand, mixed. This done at the end of February, gives great vigour to the plants. For at this ſeaſon of the year rains generally ſucceed, and waſh the lime down to the roots of the wheat: but if dry weather follows this operation, it is attended with dangerous conſequences, from its great heat, and corroſive quality.

It is plain, from what has been ſaid, that the uſe of quick-lime is attended with riſk, unleſs where it has proper matter to operate upon: and that in land where ſuch matter does not exiſt, a ſmall quantity of quick-lime is ſufficient to impregnate a great quantity of earth, and to impart to it a high degree of the abſorbent quality, which is ſo uſeful in attracting from the air that fertilizing fluid, which, if it doth not conſtitute the food of plants, at leaſt greatly improves it.

There ſeems to be one general prejudice reſpecting the uſe of quick-lime, amongſt the inferior claſs of farmers, who ſeldom examine with much accuracy into the hiſtory of facts, but take them looſely from tradition. The miſapprehenſion I complain of, and which I would gladly remove, is, the notion that quick lime is an excellent manure for light land, but a bad one for ſtiff or heavy ſoils. Upon referring to what I have ſaid of quick-lime, the contrary will be found to be the fact.

In ſtiff or heavy land, it ferments, ſeparates the ſoil, excites its vigour, abſorbs its acidities, and corrects its coldneſs. In light ſoils, it increaſes their drought, and the heat of that fever, of which they have already too much reaſon to complain. It is true indeed, that with them too it will act as a ſtimulus to vegetation; but by an overſtrained exertion, it will ſo debilitate the unhappy parent, as to render her unfit for future fecundity.

It only remains, to give ſome account of the utility of quick-lime in mixens; of which I ſhall preſently have occaſion to ſpeak.

Chalk promotes putrefaction, and is a durable and valuable manure for almoſt every kind of land. Pliny tells us, it was the cuſtom of the ancient Britons to chalk their lands, by which they received a great and laſting improvement.

There are different qualities of chalk, which ought to be diſtinguiſhed. The hard, dry, and firm, is much the fitteſt for burning into lime; but the ſoft, unctuous chalk, is far the beſt to be uſed crude. This oily, viſcous ſort of chalk is uſed in many places inſtead of calcareous marle, to which it is nearly allied, though of an inferior quality. It is even called marle in the Iſle of Wight, where their chalk is of a remarkably fat, ſoapy nature, and they ſometimes lay twenty-five waggon loads of it upon an acre of ground. It is not only a great corrector, or opener of ſtiff ſoils, but likewiſe a fine abſorbent of all acidities in the earth: its putrifying quality changes the very nature of the ſoil, making it rich, and mellow for a time. But though its effects, as a corrective, may laſt for a conſiderable number of years, yet it ought not to be relied on for a long period, as affording a ſufficient ſupply of vegetable food. Dreſſings, therefore, of a more fertilizing quality, and productive of mucilage, ſhould follow that of chalk, of which frequent repetitions will not anſwer.

The beſt method of uſing chalk, in which both Worlidge, and Mortimer agree, is, to mix it with earth, mud, or dung; about one load of the former, to two, or three of the latter. This will make it a very durable advantage to the land; and the improvement will be ſtill greater, if this compoſt be ſuffered to lie for a year or two, during which time it ſhould be frequently ſtirred and mixed. It has been obſerved to do moſt good to thoſe lands, which lie fartheſt from any natural beds of it; the ground near theſe beds partaking of its nature, though not viſible to the eye.

The common method of chalking land, is to lay twelve, or fourteen loads upon an acre; and this will ſometimes improve the ſoil ſo much, as to make it bring good crops for fourteen or fifteen years together. This quantity, however, I think too little on a ſtiff ſoil, where twenty-five to thirty loads are not too much; there being no danger from this, as from quick-lime; as it will not force the land to ſuch ſtraining exertions.

It is beſt to carry the chalk upon a lay, a year or two before it is plowed in; by which means, it will ſweeten the ſurface of the earth, and will not work down ſo faſt, as when plowed in at firſt. It is much better, and more efficacious when broken into ſmall pieces, of four, five, or ſix inches ſquare, than when laid on in larger lumps. It makes corn yield well; and when laid upon graſs ground, it renders the graſs ſweet and rich; and the cattle that feed there, ſoon fatten. Cows alſo, in theſe paſtures, are obſerved to give better milk.

It is a remarkable property in chalk, that it is not only a great improver of ſtiff ſoils, but has alſo very excellent effects on looſe and light ones: for as it opens and ſeparates the ſtiffeſt clays, ſo it gives tenacity and firmneſs to looſe and ſandy ſoils. Being of an unctuous, cooling nature, it alſo communicates thoſe qualities to lands, otherwiſe too looſe, too dry, and too hot. Thus the farmers about Cheam, in Surrey, are no leſs anxious to dreſs their lands with chalk, than thoſe who cultivate the clayey grounds of Hertfordſhire: and both ſucceed upon ſoils ſo diametrically oppoſite.

They have an excellent way of digging chalk in Kent, where it lies on the ſides of hills. The workmen undermine it a good way, and then dig a trench at top, as far diſtant from the edge as the undermining goes: this trench is filled with water, which ſoaks through in the ſpace of one night, and the whole flake falls down at once.

In other parts of the kingdom, chalk muſt be dug for, to conſiderable depths; from whence it is drawn up in buckets, containing two buſhels: twenty of theſe buckets are in this county (Herts), reckoned a load; which load is dug and drawn at ſixpence, utenſils included, and alſo the ſinking of the pit. If the chalk is wheeled over the field, it is charged two pence per load more; that is, eight pence in all. The proper time for performing this work is, after Michaelmas; that the froſts may ſhatter and crumble the chalk, as it lies on the ſurface: for if it is drawn in ſummer, the heat of the ſun, and dryneſs of the air, will ſo harden it, that it will, when plowed in, remain unbroken in the ground for many years.

As chalk, in common with marle, and other mild calcareous earths, is a promoter of putrefaction, it muſt of courſe become an uſeful ingredient in mixens.

After what I have here ſaid concerning the great advantages of chalk, the farmers of this county ought to reckon themſelves fortunate in having abundance of this uſeful foſſil, at no greater depth from the ſurface.

It has been matter of controverſy, and I believe remains ſtill undecided, whether ſtones are, or are not, beneficial to arable land. To decide this queſtion, it is requiſite to be informed of the quality and dimenſions of theſe ſtones. If they be large, and ſuch as impede cultivation, it is ſurely beſt to have them removed. If ſmall, or of a calcareous quality, it is beſt to allow them to remain; having been frequently found of advantage in protecting the ſoil, and young plants, from the ſcorching heat of the ſun, and in preſerving the moiſture. Some ſpots, very fertile in ſeveral kinds of grain, ſeem to conſiſt of nothing but ſtones: and inſtances are given, of fields being rendered barren, by taking away the ſtones which covered them. Mr. Evelyn is clearly of opinion, that huſbandmen rather impoveriſh than improve, thoſe grounds which are almoſt covered with ſtones, eſpecially where corn is ſown, if they pick them off too minutely; becauſe they thereby expoſe the land too much to the effects of heat and cold. Certain it is, that a moderate mixture of ſmall gravel preſerves the earth both warm and looſe, and prevents too ſudden exhalations. But if the farmer is willing to try the improvement of his land, by the removal of what he may reckon a ſuperabundance of ſtones, he will do well to make his experiment on a ſmall ſpot, till the effect is fully demonſtrated.

Aſhes made from foſſil ſubſtances belong properly to this article. Turf and peat-aſhes muſt needs be very uſeful; they acting nearly in the ſame way as the burning of land, and containing always a ſmall portion of alkaline ſalt.

Mr. Miller thinks they are better for being mixed with lime before they are laid on. Mr. Ellis's diſtinction between the aſhes of the lean peat, and thoſe of the fatter kind, ſeems to be founded on reaſon as well as experience. If barley, ſays he, be ſown ſo late as the beginning of May, lean peat aſhes may be applied over it, or harrowed in with the grain; but aſhes from fat black peat, ſuch as is dug at Newbury, are of ſo ſulphurous a nature,* that farmers are afraid to lay them on their barley; nor do they dreſs their wheat with them till the ſpring is advanced, and then they are ſown over it.

The earth of which this rich manure is made, continues Ellis, is taken from a black mooriſh ground, with a narrow wooden ſcoop, which brings it out like a long brick. Theſe pieces of ſwampy earth are laid on the ground to dry, in the ſummer; after which they ſell for eight ſhillings a waggon-load, for fuel. But when they are to be uſed for manure, after being dried, they are burnt in heaps of ten, twenty, or thirty loads; laying on more peat upon the outſides, as the fire increaſes within, to keep it from having too much vent. The great uſe of theſe aſhes was diſcovered about thirty (now eighty) years ago, but they ſoon after fell into diſrepute, owing to the injudicious management of people, who imprudently laid on too great quantities of them; by which means their corn was burnt. They found afterwards, that ſix, or at moſt ten buſhels were ſufficient to be ſown over an acre of wheat, peas, turnips, clover, rape-ſeed, or ſainfoin, as early as could be done. But many are afraid to ſow them over barley, leſt a dry ſeaſon ſhould enſue and burn it up: for theſe aſhes are thought to contain three times as much ſulphur as there is in coal aſhes. This is reaſonably ſuppoſed, from their ſtrong ſulphurous ſmell; their ſparkling and jumping when ſtirred while burning, and their drying up corn by their too great heat. Theſe peat aſhes, and likewiſe thoſe of wood or coal, will help to keep off the ſlug from peas and other grains, by the ſalt and ſulphur contained in them; and conduce very much to their preſervation in cold wet ſeaſons. But no danger of over-heating need be feared from the aſhes of that peat, which grows, as turf, over ſandy bottoms; as great quantities do, on Leighton-heath in Bedfordſhire: for theſe are as much too lean, as the others are too rank. Thus far Ellis.

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* I ſuppoſe, a ſtrong alkaline ſalt; for any thing really ſulphurous, would be perfectly noxious.

A gentleman in France, having met with a foſſil of this kind, communicated his diſcovery to M. du Hamel, who, judging that it might be of ſervice to others who ſhould meet with the ſame ſort of earth, has obliged the public with the following account of it:

"This foſſil is a blackiſh earth, like the ſoil of ſome meadows. When burnt, it emits a thick, diſagreeable, ſulphurous vapour. A certain degree of moiſture helps to make it burn; though even then, it waſtes but ſlowly. After it has once taken fire, it burns on of itſelf; but without producing any flame. It is of ſo cauſtic a nature, that it would flay the hands and feet of the men who knead it, if they did not take precautions to guard againſt that inconvenience. Its aſhes retain this cauſtic quality; for the hands of the peaſants who ſtrew them are hurt by it, if the air be at all damp. This earth, in its natural poſition, runs in veins of different ſizes; ſometimes ſeven or eight feet thick, and thirty or forty feet long; and ſometimes they extend four or five hundred feet; after which the vein fails at once, and is not found again till two or three miles off. Theſe veins generally lie pretty near the ſurface of the earth; ſeldom deeper than twelve or fifteen feet. This earth is found only in marſhy places, which muſt ſometimes be drained before it can be come at. It ſhews itſelf, by a ſlimy ſkin upon the waters around.

Three pounds of this earth being diſtilled, produced about fifteen ounces of a bituminous oil, pretty much like that extracted from pit-coal; and the caput mortuum (or reſidue after diſtillation) yielded, when waſhed, about half a pound of copperas*. The method of preparing this earth, in order to render it fit for fertilizing land, is as follows:

Water is thrown over it, and two or three men knead it with their feet, till they bring it to the conſiſtence of a paſte, which is then made into cakes, of ſeven or eight inches diameter. Theſe cakes are laid by to dry; though not to ſuch a degree, but that there ſtill remains a little moiſture in them; that being neceſſary to facilitate their burning. The cakes thus prepared are piled up, in the form of a pyramid, with ſufficient ſpaces between them, for the fire to penetrate; and under this pyramid, which is made upon a kind of hearth; a little ſtraw, and bruſh-wood is laid to ſet them on fire. Two or three days after, the aſhes are ſpread with a rake, that they may cool. Some veins of this earth yield white aſhes: but they are not ſo good as thoſe of a reddiſh hue.

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* Where there is ſo large a proportion of copperas, I ſhould have thought it a very dangerous manure; unleſs corrected by calcination, or by long expoſure to the air.

From fifty to ſeventy pounds of theſe aſhes are ſpread upon each acre of land, in April, or May; and, in about a week's time, the blades of corn, or graſs, if it be paſture land, aſſume a new verdure, and appear ſurpriſingly ſtrong, even in the coldeſt ſoils*.

Some of theſe foſſil earths are better than others. Care muſt be taken to rake out the aſhes of each pyramid, as ſoon as it is nearly burnt; for they would loſe a great deal of their virtue if left in the fire, till all that is inflammable be conſumed: nor would the fire go out in leſs than a fortnight, or three weeks, if they were not ſcraped away as they are burnt. It is needleſs to ſay, that a greater quantity of the inferior aſhes muſt be uſed, than of thoſe which are ſtronger; but it may not be amiſs to obſerve, that, in general, wet lands require more than dry ſoils. The effects of this manure will be viſible for two, or three years. It might be dangerous to renew it every year; for, being ſo powerful a forcer, a repetition would be fatal. There ſeems to be ſome analogy between this and foſſil coal. It ſmells diſagreeably ſulphurous and bituminous, when burnt, and its aſhes ſeem to contain iron. I believe the aſhes of foſſil coal might likewiſe ſerve to fertilize land."

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* The elutriation firſt, and the calcination afterwards, muſt decompoſe the copperas.

This laſt obſervation of M. du Hamel's muſt appear puerile to us, who have been ſo long in the practice of dreſſing our lands with coal aſhes. Nor is it at all to be doubted, but that this foſſil earth which he deſcribes, as well as the Newbury peat, is an unformed pit-coal, impregnated with green vitriol, and perhaps ſome other mineral ſalt, which renders it ſo cauſtic. The iron found in the aſhes, ſhews that it has been ſeparated from the vitriolic acid, with which it was formerly combined, forming copperas, or green vitriol.

Sea ſalt has been often uſed as a manure, ſometimes by itſelf, but more frequently in compoſts. It has, however, been long a point in diſpute, whether it be really a good manure, or not; and many inſtances are brought of its ſucceeding, and of its not ſucceeding; and both may be equally juſt. For the ſucceſs of this manure, like that of quick-lime, or of any other neutral ſalt, entirely depends upon the nature and ſtate of the land upon which it is laid. All neutral ſalts, of which ſea ſalt is one, are well known to be antiputre-

ſcent,

ſcent, and forcers of the ſoil. To employ them with propriety, the ſoil ſhould be charged with other food, or mucilage; which they tend to waſte, or exhauſt, by forcing the vegetation.

A ſmall quantity of theſe ſalts will produce a conſiderable effect; probably, ſays Dr. Fordyce, by deſtroying the weak fibres of the roots of plants, and giving occaſion to them to puſh out more numerous, or ſtronger ones. Perhaps they may prevent too quick an evaporation of the moiſture; or they may aſſiſt the digeſtive faculties of the plant. But, as forcers, they are undoubtedly very improper manures for poor, or exhauſted lands.

Wood aſhes, or the aſhes of burnt vegetables, although not of the foſſil tribe, yet may not improperly be ſpoken of here; as partaking much of the quality of thoſe manures we are now treating of. Their ſtrength, as a manure, depends upon the quantity of alkaline ſalts with which they are impregnated; and the quantity of ſalts they contain, depends greatly, as before obſerved, on the ſeaſon of the year, and the manner in which they are calcined.

The alkaline ſalt of vegetables differs from the neutral ſalts, in this reſpect; that it does not impede putrefaction, but rather promotes it. It is however, like them, a forcer of the ſoil, and ought only to be employed where there is a ſtock of mucilage, or vegetable food, to operate upon. Eighty buſhels of good aſhes to an acre, is a ſufficient dreſſing*.

Of the ſame nature alſo are ſoap aſhes, or ſoaper's aſhes, as they are often called. It is well known, that theſe are a mixture of effete lime, and barilla, which, after producing a ſtrong alkaline ley, of which ſoap is made, have yet ſome remains of their alkaline ſalt; which, mixed with the effete lime, make together an admirable dreſſing, both for arable and graſs land. But the ſame precautions muſt be uſed with regard to them, as has been recommended in the employment of other alkalis; being, like them, forcers of a powerful nature.

The aſhes of the ſea weed known by the name of kelp, being of the ſame nature, muſt be treated in the ſame way.

Soot, in many caſes, is an admirable and uſeful manure. It alſo is ſtrongly impregnated with a neutral ſalt, and is a forcer of the ſoil. It is too dear to uſe in great quantities, and therefore is chiefly employed as a top-dreſſing, by ſowing it over wheat, barley, and ſometimes turnips, and clover. This is done generally in the month of March, to the amount of twenty to twenty-five buſhels an acre. The rain, which commonly falls about that ſeaſon, waſhes it down to the roots of the plants, and makes them aſſume a wonderful and vigorous verdure. From its extreme bitterneſs, it proves an effectual poiſon to inſects, which at this ſeaſon, when they begin to breed, and to ſwarm, is doing a moſt eſſential ſervice to any crop*.

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* Mr. Arbuthnot tried wood aſhes on arable land, without finding much advantage from them: his quantity was twenty-five buſhels per acre. Their benefit on graſs land was conſiderable, but they ought to be ſtrewed immediately from the cart, and not ſuffered to lie in heaps; otherwiſe they will burn up the graſs to the roots.

There is another manure of this forcing kind, which I muſt not omit to mention, though its utility is confined, as it can only be had in the neighbourhood of great trading towns; I mean, the ſcum of ſugar-baker's pans. To purify the ſugar, a portion of lime, and bullock's blood is uſed. In the progreſs of the operation, the lime, blood, and coarſer particles of the ſugar, are thrown to the top, or ſurface of the boiler, by the heat of the fire; and this mixture, being ſkimmed off, is laid aſide as uſeleſs refuſe. This may be bought at the ſugar-houſes at a moderate price; and is ſo excellent a manure, that two cart loads of it will ſufficiently dreſs an acre of plowed or graſs land: or it will form a very rich ingredient in any well-compounded mixen.

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* Mr. Arbuthnot ſowed thirty buſhels per acre on graſs land, at ſeven pence a buſhel, beſides carriage, and a penny per buſhel ſowing. From various trials, the effects were found to be very great, if done early in February; and equally beneficial, if ſown on wheat at the ſame time.

ARTICLE II.

Of Vegetable Manures.

HAVING now treated very fully of foſſil manures, both of thoſe which are promoters of putrefaction, and of thoſe which are properly named forcers of the ſoil, from their powers of ſtimulating and forcing the land to exert its vegetative qualities, while it has ſtrength to act, or matter to beſtow; I ſhall next proceed to enumerate the manures produced by vegetable ſubſtances: theſe are of a very different nature from the former; as they are actually, from their mucilagenous quality, the real food of plants, and are prepared, fermented, putrefied, and made uſeful, by the means I have juſt deſcribed.

Moſt vegetables afford excellent manure; and the cuſtom of plowing in green ſucculent plants, for that purpoſe, is very ancient. The Roman writers commend

mend it highly, and with much reaſon. Columella recommends lupins particularly, as a manure which if cut down, and turned in when green, will have as good an effect as the beſt and ſtrongeſt dunging whatever. They may be ſown upon poor land about the beginning, or middle of May, and will enrich it greatly, if plowed in before they attain their full growth. In gravelly ſoils, they ſhould be cut down after they have put forth their ſecond flower; and in ſtrong lands, after the third. In the former of theſe grounds, they are turned in while young and tender, that they may quickly rot; and in the latter, they are allowed to ſtand till they grow ſtronger, that they may bear up the more ſolid and ſtiffer clods of earth, and keep them the longer ſuſpended; by which means, the air has freer acceſs to the ſoil, and theſe clods being heated and dried with the ſummer's ſuns, are the more eaſily opened, and turned into duſt. Thus ſays the judicious Columella, juſtly remarkable for his ſuperior ſkill in huſbandry.

Peas, beans, buck-wheat, tares, turnips, cabbages, and other ſucculent plants, yield much matter for mucilage to the ground; and, if plowed in after a winter's fallow, and during the courſe of the ſummer's plowing, together with a dreſſing of dung, they will effectually reſtore the moſt exhauſted ſoil.

Theſe plants plowed in, while in full bloom, at which time they abound moſt in ſap, are a fine dreſſing for looſe ſandy land; giving the tenacity it wants, and the pabulum, or mucilage, it ſtands ſo much in need of.

In Piedmont, where this manure is much uſed, they ſow lupins upon their fallow lands, towards the end of June, immediately after the ſecond plowing; ſo that they are in full vigour and ſap when the third plowing is given, and the corn ſowed. Buck-wheat, and tares, or vetches, are the two plants moſt commonly ſown in England, for manure. They are plowed in while in full bloom, being then in their moſt ſucculent ſtate. Some farmers turn in their ſecond crop of clover, to enrich the land for wheat in autumn. I obſerved before, that this practice might be much improved, by giving the land a dreſſing of ſixty or eighty buſhels of quick-lime before it was plowed. This would haſten the fermentation of the plants plowed in, and bring them into a rich ſoapy ſubſtance*.

Mr.

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* When it is conſidered, with what ſmall expence of prime-coſt, carriage, and other charges, this excellent manure is obtained, I think we may ſafely ſay, that although leaſt uſed in England,

Dr. Elliot, of New England, preferred millet to any other plant, for a green dreſſing, on account of the cheapneſs of the ſeed, and the largeneſs and ſucculence of the ſtalks and leaves.

The weeds of ponds, lakes, rivers, or ditches, being dragged out before they ſeed, and laid in heaps to rot, will make excellent manure; as well as moſt other ſorts of weeds, and almoſt all kinds of rotten vegetables, excepting thoſe whoſe juices are very bitter, reſinous, or aſtringent*. But whenever any weeds are employed, they ſhould be cut down as ſoon as they begin to flower: for if they are ſuffered to ſtand till their ſeeds are ripe, the land will be filled with weeds, which can hardly be deſtroyed in two or three years; nay, ſome kinds of weeds, if allowed to ſtand till their ſeeds are formed, will perfect them after they are cut down, and be equally prejudicial to the ground. The ſureſt way is, to cut them when they begin to flower, at which time all vegetables

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England, it is the moſt œconomical of all others. I ſeriouſly wiſh, that both gentlemen and farmers would advert to this, and reap advantage from it.

* Mr. Wagſtaff, a correſpondent of the Bath Society, ſeems to think, that he has found out a new manure, when he recommends the uſe of weeds from rivers. But ſurely theſe are only a part of the vegetable creation, ſo often, and ſo generally mentioned. They are no ſtimulus, as he improperly calls them; but furniſh mucilage, or the food of plants.

are in their greateſt vigour, and fulleſt of ſap, and are thus fitteſt for being converted into good manure.

This conſideration ought to be the ſtrongeſt motive poſſible with all farmers, to clean their hedges, ditches, and other waſte places, of the weeds which are often to be found there; as this labour anſwers two ſuch excellent purpoſes; namely, the keeping their lands free from ſuch nuiſances, and at the ſame time preparing for theſe lands a valuable body of the richeſt manure.

In rotting theſe vegetables, it is highly proper to mix with them layers of marle, chalk, lime, or even earth: for theſe would not only accelerate the putrefaction, but would alſo greatly improve the compoſition, and prevent them from taking fire in their fermentation; a circumſtance very likely to happen in large heaps. Theſe heaps ſhould likewiſe be covered over at top, to prevent the volatile ſalts from flying off, which they would otherwiſe be very apt to do, during the proceſs of the putrid fermentation. When theſe vegetables are thus thoroughly rotted, they will form a ſolid maſs, which will cut like butter, and be oily and ſaponaceous, furniſhing a large quantity of that mucilage, which is, undoubtedly, the moſt nouriſhing food of plants.

Sea weeds are ſo beneficial a manure, that farmers ought not to grudge the expence of carrying them a few miles. In Devonſhire, Cornwal, and other maritime parts of Great Britain, theſe weeds are laid in heaps till they are rotten, and then ſpread upon the land, about forty or fifty loads to an acre: but this affords only a temporary improvement, unleſs theſe weeds are mixed with layers of ſand, or chalk, lime, or clay, according to the quality of the ſoil intended to be dreſſed; and then they become a rich, uſeful, and laſting manure. In ſome places, theſe weeds are collected in heaps, and burnt as ſoon as they are dry: but this is a bad method, and can be practiſed only by the ignorant. If it is required to have their ſalts in full force, they ſhould be burnt when wet, and they will then produce a ſtrong, and forcing alkaline ſalt, or kelp; of which I have already ſpoken. But as a fertilizing manure, they are beſt uſed as above directed; which has alſo the advantage of being attended with leaſt trouble to the huſbandman.

Looſe ſoils are peculiarly improved by this weed, which being a ſub-marine plant, the wind and ſun ſoon exhale its moiſture; ſo that the more ſpeedily it is taken from the ſhore, where ſtorms often throw it up in great quantities, the better, and richer it is.

Some people carry it directly from the ſhore, and lay it upon the land; where, if it is plowed in, it ſoon diſſolves into a ſalt oily ſlime, extremely proper to fertilize and bind light ſoils.

The value of the lands along the coaſt of Scotland has been more than doubled by the uſe of this excellent manure. It is beſt to lay it on the land in autumn, or winter; and it ſhould be ſpread and plowed in immediately, that it may not be allowed to dry, and its virtues be exhaled. It will thus be rotted, and incorporated with the ſoil, before the laſt corn is ſowed; and thus its good effects will be felt in the ſucceeding crop.

Theſe weeds are ſometimes thrown on ſhore by the waves, at a time when it would be extremely inconvenient, or improper, for the farmer to carry them over his land; in which caſe, they ſhould be made into ſuch mixens as I have already deſcribed, and there lie till they are fit for further uſe: taking particular care to have the mixen well covered at top, like other vegetable mixens, to prevent the evaporation of the volatile ſalts.

The ſea weed that is cut from the rocks at low water, is ſaid to be infinitely ſtronger than what is thrown on ſhore by the ſea. It is procured with greater labour, and that is repaid by its greater virtue.

In kitchen-gardens, it has been found to produce pot-herbs and roots of an extraordinary ſize; and fruit-trees which were quite barren before, have been rendered extremely fruitful by laying this manure about their roots.

Rotten tanners-bark is another excellent manure, not much known to farmers. The rotten and putrid bark of trees, in general, contains vegetable ſalts, and mucilage, which render them very uſeful manures. One load of oak-bark laid in a heap, and rotted, after the tanners have uſed it for dreſſing of leather, will do more ſervice to ſtiff cold land, and its effects will laſt longer, than two loads of the richeſt dung. Mr. Miller is certainly right in thinking it better for cold ſtrong land, than for light hot ground, if it be uſed alone, as taken from the tan-yard; becauſe it is of a warm, fermenting, and mucilaginous nature, which will looſen and ſeparate ſo effectually, that, by uſing it only three or four times, a ſtrong ſoil, not eaſy to be wrought, will be rendered perfectly light and looſe: but by mixing it with earth of a nature contrary to that which it is intended to correct, and in proportion to the quality of the ſoil upon which it is to be laid, it will prove a fine manure for any land; its mucilage and ſalts greatly fertilizing the ground. It will even alter the very nature of the ſoil, and turn it into a rich black mould. For, beſides the vegetable ſalts and mucilage with which it abounds, it muſt alſo be ſtrongly impregnated with animal juices; as it lies long in the tan-vats, with the ſkins and hides of animals, which muſt make it very beneficial to poor lands. If laid on graſs land, it ſhould be ſpread in autumn, that the winter rains may waſh it into the ground: for if it is delayed till ſpring, it will be apt to burn the graſs; and inſtead of improving it, will do it much injury for the ſeaſon. When uſed for corn land, it ſhould be ſpread before the laſt plowing, that it may be turned down for the fibres of the corn to reach it in the ſpring: for if it lies too near the ſurface, it will forward the growth of the corn in winter; and in the ſpring, when the nouriſhment is chiefly wanted, it will not lie ſufficiently deep to favour and promote the ſpreading of the roots.

All barks, or rinds of trees, though not ſo good, perhaps, as that of oak, which is the ſort principally uſed by tanners, muſt needs enrich either corn or paſture land. Theſe however, like other vegetable ſubſtances, ſhould firſt be formed into mixens, with putrefying or diſſolvent bodies, and allowed to remain ſo, till brought by fermentation into a putrid ſtate; when they are fit for uſe. Of this kind is the earth found in the bodies of old decayed willow-trees. For the ſame reaſon, rotten wood, ſaw-duſt, fern, ſtraw, brake, ſtubble, ruſhes,

thiſtles,

thiſtles, leaves of trees, or any other vegetable traſh whatever, caſt into the yard among the cattle, or ſwine, or thrown into pools or places to rot ; mixed with putreſcent matters ; muſt be converted into good manures : but hot lime will be moſt ſpeedy in its effects. The lees of wine, the grounds and ſettlings of beer, ale, &c. are of the like nature, but ſtill more excellent. In wine countries, the remainder or reſidue of the grapes, after they have been preſſed, is found to be a very rich manure : and ſo are the remains of all ſubſtances out of which oil is made.

Oil cakes, that is, the cakes of lin-ſeed, rape-ſeed, &c. after the oil has been preſſed out of them, at the mills, are much uſed for manure in ſome parts of Cambridgeſhire, and in the north part of Eſſex.

Theſe cakes are ground to powder in mills, then ſtrewed upon the ground, and plowed in. A thouſand cakes, weighing about two pounds and a half each, are enough to manure three or four acres well, and will now coſt five or ſix pounds ; though, not many years ago, they uſed to be ſold for twenty ſhillings a thouſand. They are profitable to land, turning to a fine mucilage ; and help to bring luxuriant crops. Old farmers uſed to have a prejudice againſt them ; imagining, from the vigour of the crops, that they forced and exhauſted the ſoil :

ſoil: but this could only be the effect of prejudice; this vegetable ſubſtance having nothing in its nature that can force, or exhauſt. If, however, it be thought too rich of itſelf, it is eaſy to remedy that defect, by mixing it with mould, or ſome other leſs fertilizing ſubſtance.

Malt-duſt is accounted a great enricher of barren land, eſpecially if the ſoil be clayey. It proves moſt beneficial, when rain chances to fall ſoon after it has been ſtrewed; becauſe it is thereby waſhed into the earth before it has loſt its ſtrength. The common cuſtom is, to ſprinkle about forty buſhels over an acre of land, juſt after it has been ſown with wheat, or barley. In ſome parts of Berkſhire, they ſow it with their wheat, and harrow both in together: a method which is found to anſwer very well. Some farmers hold it to be better for ſummer-corn, than for wheat; becauſe the winter-corn remaining almoſt a year in the ground, the malt-duſt will have loſt much of its ſtrength before winter is over; and will not thus be able to keep the corn in heart all the ſummer. In this way it ſerves only for one crop: but Mr. Bradley is of opinion that it might be rendered far more beneficial, if it was to be mixed with ſandy or light earth, in the proportion of one to five of the earth; and then, being equally ſpread, to be plowed in ſhallow, not exceeding the depth of three inches *. It is eſteemed a great improver of cold graſs-ground.

I muſt, however, obſerve here, that both theſe laſt mentioned manures, howſoever uſeful in this way, are now much leſs common than formerly, from their late increaſed and ſtill increaſing price, as being an excellent food for cattle. Oil-cakes are therefore much uſed for fattening of bullocks; and malt-duſt for hogs, cows, and a winter trough-meat for ſheep.

Dyers dung is much commended as a very good manure for all ſorts of land. Two loads of it are ſufficient for an acre.

ARTICLE III.

Of Animal Manures.

ANIMALS, and every part belonging to them, yield the richeſt and moſt general of all manures.

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* Mr. Bedford, of Eſſex, a correſpondent of the Bath Society, (Vol. III. p. 391.) mentions his having manured ſome land with malt-duſt, giving it four quarters per acre. He then ſowed it with barley, and clover; the former of which produced ſeven quarters an acre, and the latter was one of the fineſt crops he ever ſaw: nor did he doubt, but the effect of this dreſſing would be evident in next year's crop of wheat. The malt-duſt coſt him only two ſhillings a quarter, which is at the rate of eight ſhillings an acre.

They run immediately into putrefaction, without paſſing through the different ſtages of fermentation to which vegetable ſubſtances are liable. By putrefaction, animal ſubſtances are preſently converted into mucilage, or the food of plants; and nothing can afford a more effectual improvement to every kind of ſoil; for it gives tenacity to ſand, and friability to clay: and as it gives viſcidity to water, it prevents its ſudden evaporation, and preſerves in the ſoil a laſting and viſcous moiſture, which, together with heat, are the very life and ſoul of vegetation.

Animal ſubſtances may be divided into the following claſſes:

The fleſh, blood, bones, horns, hair or wool, dung, and urine; which are all converted, by putrefaction, into the moſt valuable manure; though the excrements of different animals differ ſomewhat in their qualities.

The fleſh and blood of all animals require nothing but putrefaction, to make them univerſally ſerviceable. Bones are better for being broken, or bruiſed in a mill: thirty or forty buſhels per acre, either on graſs or corn land, will have wonderful effects. Horns and hoofs are beſt uſed in the ſame manner, and will laſt in the ground five or ſix years.

All ſorts of hair, being thinly ſown, or ſpread, and ſuffered to putrefy, make a great improvement on corn lands. It is light of carriage; twenty or thirty buſhels are enough for an acre, and will laſt in the ground for two or three crops.

Feathers and wool, or woollen rags, are alſo a good manure for corn land. They ſhould be chopped ſmall, and ſcattered on the earth at the ſecond plowing: for being thereby covered, they will begin to rot by ſeed time. They imbibe the moiſture of dews and rains, retain it long, and by theſe means keep looſe ſoils in a moiſt ſtate, and ſtrong ones open and hollow. They coſt about four pence a buſhel at London, from whence many loads are carried to thirty miles diſtance, and are uſed both on ſtiff and light lands, juſt after the ſowing of the corn, allowing to an acre ſix ſacks of four buſhels each.

The dung of fowls, rabbits*, pigeons, and human ordure, &c. are extremely hot, being charged with a large proportion of earthy ſalts; as are alſo dunghills, when allowed to become too putrid.

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* Rabbit's dung was the top-dreſſing generally uſed by Mr. Arbuthnot. He ſowed twenty-five ſacks an acre over moſt of his wheat, in March, at one ſhilling and two pence per ſack, carriage included: on the drilled crops he hoed it in; on the broadcaſt he harrowed it in. The effects were excellent. He made a comparative trial of the rabbit's dung, chicken's dung, and wood aſhes, eighteen ſacks of each per acre. The chicken's dung was far the beſt, the rabbit's next, and the wood aſhes laſt.

All theſe are extremely aſſiſting in the converſion of other putreſcible ſubſtances into mucilage. This points out their utility where ſuch converſion is required; particularly in mixens, which are wanted to be thrown ſpeedily into a ſtate of putrefaction; or in lands charged with large quantities of putreſcible matter, not yet converted into mucilage; where ſome green crop, perhaps, has been plowed in.

Theſe hot dungs are alſo extremely uſeful when mixed with aſhes, or mould, and reduced to powder, and are thus employed as a top-dreſſing over wheat, or clover, in the month of March; for the rains will waſh down their earthy ſalts to the roots of the plants, and give a freſh ſpur to vegetation.

Farm-yard dung, which is generally compoſed of horſe and cow-dung, and ſtraw, with the dung of hogs, and ſome incidental additions, ought not to be allowed to putrefy too much; that it may not come into that ſtate of earthy ſalt, which I have here deſcribed. It will be found more uſeful in ſupplying mucilage to the land; and for that reaſon ſhould not be allowed to lie expoſed to the heat of the ſun, the rain, or the winds, which diminiſh and exhauſt its virtues: therefore it ſhould be plowed in ſoon after it is carried upon the land; and when blended with the

ſoil,

ſoil, it will thus preſerve, entangled in the earth, its moſt valuable parts, its oily, and volatile ſalts.

The dung of ſheep deſerves particular attention, as being of moſt general utility. The common way of conveying it upon land is, by folding the ſheep themſelves upon it, by which means their urine, as well as their dung, become uſeful.

Ellis is extremely diffuſe in his encomiums upon this mode of dreſſing land; and I am convinced it is attended with great advantage, at perhaps, leſs expences than any other dreſſing whatever; eſpecially upon very hilly grounds, where carriage by carts becomes both tedious and expenſive, beyond meaſure.

He obſerves, that the dung of ſheep muſt be richer, and more charged with ſalts, becauſe theſe creatures drink little or none. Hence it is, ſays he, that this ſaline excrement is ſo powerful an antidote to all inſects; ſuch as worms, ſlugs, grubs, flies, and caterpillars, as we find to our great profit, by folding before, and after the ſowing of turnips, wheat, barley, and other ſeeds; and when fed on hay or ſtraw in yards, in the winter, they are of vaſt ſervice in converting ſtover to one of the beſt of dungs. The ſtale of ſheep is alſo hotter and ſalter than others, from the ſame cauſe,

cauſe; and therefore is of a more fertilizing quality.

The dung and ſtale of theſe animals are very efficacious on all manner of loams; but ſtill more ſo on gravels, chalk, and ſands; becauſe theſe grounds, being of a light hollow nature, eſpecially the two laſt, are, by the help of the fold, brought into a cloſer union of parts, in ſuch manner, that this dreſſing mixes with, and ſticks to this looſe ſhort earth, ſo as to render it tenacious, and enables it to yield its ſoil to the corn.

The dreſſing by the fold has this great advantage, that it is carried to the field by the ſheep themſelves, which ſaves both time and expence.

This, however, ſhould not be truſted to, as the only manure required by land: for that affects alternate dreſſing, as much as it does alternate crops.

Where wheat is winter-proud, that is to ſay, grows up too ſtrong and too forward in the ſpring, nothing anſwers better than eating it down by ſheep; for this not only makes the plants tiller, by ſending forth freſh ſhoots, but alſo gives a top-dreſſing to the land, equal to many buſhels of ſoot; not only from its fertilizing quality, but alſo from the treading of the feet, which conſolidates the ground, and fixes the plants in the ſoil made looſe and ſpungy by the winter's froſt.

But this muſt be done with great circumſpection; for there are many who alledge, that by depriving theſe plants of their leaves, their growth is checked, and the plant enfeebled; for it is well known, that plants draw in much nouriſhment from their leaves: beſides, if ſheep are left too long, they may bite ſo cloſe, as to deſtroy the crown of the plant, from whence its future growth ſhould proceed, as will be explained hereafter.

There is not a better manure for meadow ground, than the dung and ſtale of ſheep. It helps greatly to kill moſs, and brings up in its ſtead, a fine ſweet, and thick ſwerd.

When ſheep are folded on meadow ground in winter, it would be a great advantage to them, to ſpread ſome ſtraw, or dry litter for them to lie on, ſo as to prevent them from being hurt by the great damps of the ground.

Mr. Arbuthnot was ſo well convinced of the importance of the ſheep fold, that when his land was not dry enough for folding them upon it, it was his conſtant practice to pen them in a ſtanding fold on a head land, well littered with ſtraw every day, or every other day, ſo that the ſheep might be always dry.

One hundred and thirty-four ſheep, and thirty lambs, penned in this manner ſix weeks, were littered with five loads and forty truſſes of oat-ſtraw (forty pound to the truſs). They made twenty-eight large loads of dung. They were fed morning and evening with turnips in the pen, and let out for four or five hours in the middle of the day. They ate two acres of turnips in the above time. The dung thus made, was equal to any he could have procured at ten ſhillings a load.

Suppoſe the above quantity equal to twenty London loads	£10	0	0
Five loads and forty truſſes of ſtraw, at twenty ſhillings at the pen	5	15	0
Profit by the dung	£ 4	5	0

which leaves for the turnips, two pounds, two ſhillings, and ſix pence per acre; which, though no great matter, muſt be conſidered as the produce of a fallow.

Many farmers, however, prefer houſing their ſheep in the winter, on account of their health, and ſafety. This, where it can be accompliſhed, is an admirable method, and perhaps, is as gainful a way as any, of reaping advantage from their dung. In the ſhed, or out-houſe, where the ſheep are to lie, the floor ſhould be ſpread with ſtubble, ſtraw, or haulm, which, when fully impregnated with dung, and ſtale, ſhould be renewed from time to time, as required. The former litter,

ter, being removed to the mixen, or even laid up by itſelf, will ſoon form by putrefaction, a large body of excellent manure: better, however, if layers of chalk, marle, or effete-lime, were interſperſed, to increaſe the maſs, and accelerate its maturity.

In Flanders, they ſpread a thin ſtratum of dry mould, or ſand, in thoſe places where their ſheep are houſed, to which they add a freſh ſupply every night for a week, and then clean out the whole, and renew the bed. The mixture of ſand, dung, and urine, makes an excellent dreſſing for ſtrong land; and even where that is not required, the mould or ſand thus impregnated, will make a very valuable ingredient in any mixen.

Swines dung is alſo a very uſeful manure, and ſhould be ſaved with attention by all good farmers. For this purpoſe, the ſties ſhould be formed of planks cloſe jointed, and lying inclined towards a trough, or gangway, into which their urine may be conveyed, and be ſucked up by the ſtraw, or haulm, or whatever elſe is laid to receive it.

Their litter ſhould be cleaned out once a week; and, like that of ſheep, it makes a fine ingredient in any mixen. Some are of opinion, that the dung of theſe animals is beſt for manure, when firſt made;

made: I have good reaſon to think differently; and am convinced that, like all other excrement, it is improved by being thrown into a ſtate of putrefaction.

The farmers in Staffordſhire ſometimes ſow on poor light ſhallow lands, a ſmall white pea, which they never reap, but turn in as many hogs as they think the crop will fatten, and let them lie upon it, day and night. The dung, and urine of theſe animals enriches the land ſo much, that it ſoon acquires a thick ſwerd, and continues to be good grazing ground.

I once tried a number of theſe creatures in a field of clover, where they fattened well, and enriched the land extremely; ſo that the following year's crop was uncommonly heavy.

ARTICLE IV.

Of Compoſts, or Mixens.

NATURE preſents to us a compoſt ready prepared, conſiſting of the putrid particles of vegetables and animals, mixed with the fineſt, and richeſt mould, in the ſcouring of ponds and ditches, and often in creeks of the ſea. This, not coming properly under any of the former heads, requires my notice here, as a manure of great utility for every kind of ſoil.

This mud, or ſalt ſlime of the ſea, if not uſed in other compoſts, or mixens, ſhould be allowed to lie expoſed to the air for ſome time, till the ſeeds of ſuch weeds as may be in it are rotted, and paſt vegetation; which deſirable end would be more eaſily obtained, by mixing with it ſome marle, chalk, or lime, quick or effete.

Mr. Worlidge recommends particularly a mud, or ſludge, which he calls ſnail-cod, or ſnag-greet, as a manure, of which one load will go as far as three of the beſt horſe or cow dung. It lies frequently in deep rivers, is very ſoft, full of wrinkles, and intermixed with many little ſhells and ſnails, to which it is thought to owe great part of its fatneſs. All rivers, unleſs their waters be very clear, or their currents very rapid, ponds, pools, and ſtagnant waters, afford a rich mud; being generally the ſoil of lands, commons, roads, ſtreets, ſinks, or back-ſides, waſhed down till it finds a place of reſt, where it coſts nothing but the labour of carrying away, which it will amply repay; eſpecially if laid on light and looſe ſoils. The cleanſing of the ſtreets of great cities is itſelf a compoſt, and is a very rich and beneficial manure. The cleaning or drift of highways, where there is much traffic, though much inferior to the former, is, however, a manure of great utility to ſtiff lands, and makes an uſeful ingredient in a mixen.

In collecting manures from time to time, as they come to hand, farmers generally keep them together, in what they call dunghills, or mixens, where they remain expoſed to the heat of the ſun, the waſhing of rains, and the drying of winds; by which means all their virtues are drawn forth, and carried away. Mr. Evelyn very juſtly cenſures this practice, and gives directions for forming a ſtercorary to contain the compoſt collected by huſbandmen. His ſtercorary is extremely different from what I would recommend, and of which I have had repeated and comparative experience. The error into which Mr. Evelyn has fallen, and into which he was perhaps led by the authority of Columella*, is, that the dung ſhould be well ſoaked in liquor, to kill the ſeeds of weeds, and deſtroy their vegetative quality.

Evelyn therefore adviſes, to have a pit ſunk, to contain the liquor of every kind that can be brought into it, ſo that the dung ſhould be always immerged therein. But ſurely, neither he, nor Columella, were aware, that this extreme and continual moiſture would prevent the ſucceſſive and equal fermentations that ought to take place, in order to perfect and mature the dunghill.

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* L. I. c. vii.

Differing therefore, totally, from theſe great authorities, I will venture to propoſe, that inſtead of ſinking a pit, the dunghill, or mixen, ſhould be placed on a ſpot a little elevated above the level of the yard; or on a ſhelving ground, with a channel, or gutter, round it, into which the ſaline juices of the mixen may drain. The channel, or gutter, ſhould have a current, by which theſe juices ſhould be led into a ſmall pit, or ciſtern, ſunk on purpoſe to receive them. This ciſtern ſhould be covered with a lid of ſtrong oak plank, to prevent cattle from falling into it; which lid, folding on hinges, ſhould be opened once a fortnight, and the liquor be poured over the mixen by two men, with pails; one drawing it from the ciſtern, and handing it to the other on the top of the mixen, who ſhould then ſprinkle it all over the ſurface as equally as poſſible. This liquor ſubſiding gradually through the maſs, the various fermentations, and ſucceeding putrefaction would proceed with greater regularity.

I do not ſpeak from hypotheſis but from experience. The ſcite, or place of the dung, ſhould be paved; and the ſmoother and cloſer, the better, to prevent the liquor from being abſorbed by the ſoil. It ſhould alſo be roofed over, not only to prevent the heavy rains from waſhing out the ſubſtance, but alſo to prevent exhalations by the ſcorching heat of the ſun, which is a great exhauſter of its ſtrength and goodneſs. Six or eight brick, or ſtone piers, with a ſlight roof, tiled or thatched, can be no great expence any where, and is attended with much advantage. Under this roof, the mixen ſhould be turned three or four times in the year, which will make it ferment and putrefy more equally.

But if a roof cannot be afforded, the next beſt way is, to protect the top or ſurface of the mixen by raiſing it in the middle, like a ridge, that it may ſhoot the water to both ſides. As it is getting freſh matter daily upon it, this cannot be done with great regularity; but a tendency towards it may be of uſe; and if a layer of mould is laid on in a ridge-form from time to time, it will help to regulate the other ſtrata. Or perhaps it may, when narrow, be more convenient to give the whole mixen one ſlope or declivity from ſide to ſide.

The various ways of forming mixens are extremely numerous, and muſt be very much guided by the materials we can moſt eaſily command, and at the ſmalleſt expence. At the ſame time, attention ſhould certainly be paid to the quality of the ſoil, where the mixen is to be uſed. If ſandy, the mixen ſhould have a large proportion of rich, ſlimy, and tenacious ſubſtance: but if the ſoil is ſtrong and clayey; ſandy, loamy, chalky, or other light, looſe, and ſeparative ſubſtances, ought to prevail.

My ſoil is a clayey gravel: I will here give a ſhort ſketch of my manner of forming a compoſt.

Adjoining to the farm-yard is a pond for receiving the black water that is drained from it, by the rains, &c. In the autumn, when the weeds are cut, pulled, and collected from all quarters, they are carried into the black water pond, to imbibe its moiſture, and rot; which in this ſituation they do but ſlowly. The mixen of the former year being now carried over the fields, the next care is to prepare for the new one. For this purpoſe I collect all mould from ditches, drains, water-furrows, &c. and bring it as back-carriage from thoſe fields where the dung has been laid. This turfy mould ſoon accumulates in the yard, and being thrown together in the form of an oblong ſquare, on a ſhelving ſcite, it makes the baſis of my annual ſuperſtructure. To this ſucceeds a ſtratum of dung, from the ſtable, from the ſtye, the cow-houſe, covered ſheep-fold, or poultry, as chance directs.

Froſt coming on, a ſtratum of chalk is brought, and put over the firſt layer of dung; or, in its ſtead, road drift. Then follows dung, as before, with whatever elſe of any kind that can be accumulated. By the ſide of the mixen runs a deep channel, which is dammed up, and retains the liquor; and that liquor is uſed as before deſcribed. The whole mixen is turned, and mixed for the firſt time before the hay harveſt; on which occaſion, it gets the addition of the weeds from the black water pond. Theſe, being full of moiſture, not only refreſh the mixen beneath, but keep off for a time the burning heat of the ſun. Over them goes a new, but thin ſtratum of dung; and the whole is again turned before the corn harveſt.

After this, it receives no addition, all cattle being at graſs. It is then turned for the laſt time, and thus remains till carried to the field; when I find it ripe, fat, and mellow, ſoapy, and mucilagenous; not ſalt, or earthy: in ſhort, in the firſt, not in the ſecond, ſtage of putrefaction; leaving it to complete in the ſoil, what has been ſo well begun in the mixen.

Columella ſeems to think, that they are ſlothful huſbandmen, who, in thirty days, have not a load of dung of twenty buſhels, from each of the leſſer cattle, and ten loads from each of the larger ſort; by means of judicious mixtures with their dung. He thinks this compoſt, or mixture, moſt beneficial to corn, when it is a year old; becauſe it ſtill retains all its ſtrength, and does not then breed weeds.

It is a point which appears not to be perfectly aſcertained, whether quick-lime be or be not of uſe in theſe mixens. It is well known, that quick-lime powerfully reſiſts putrefaction: but, on the other hand, it is a rapid diſſolvent, and unites with the oily ſubſtance of vegetables; forming together a ſemi-ſaponaceous maſs. This ſaponaceous maſs is perhaps in better order for manure, than if it was actually in a ſtate of putrefaction; which putrefaction will, no doubt, come on, when it is thoroughly mixed with the ſoil. In this way it certainly operates in the earth, by diſſolving all animal and vegetable ſubſtances, and converting them to the food of plants, much ſooner than they would otherwiſe be. In the mean time, this manure is fat and mucilagenous; and muſt render the moiſture it meets and mixes with, more viſcous, and leſs apt to be evaporated. From reaſoning, therefore, and not from experience, which I have not on this ſubject, I would almoſt conclude, that quick-lime muſt be a real improver of all mixens.

The Society for promoting the Knowledge of Agriculture in Scotland, have paid great attention to the ſubject of compoſts; and give the following

ing directions to a gentleman who had clay and lime at command.

"Take, ſay they, in the field intended to be manured, a head ridge, the moſt conveniently ſituated for a ſtercorary. Plow it two or three times, as deep as can be, in the cleaving way, if the ridge be high gathered *, and harrow it well: then lay thereon your ſlimy clay, about a foot thick, leaving a part of the ground uncovered; next, lay a thin layer of dung, another of clay, and after that a layer of unſlacked lime, at leaſt a foot thick; then throw up the earth left uncovered on each ſide. After this, repeat another layer of clay and unſlacked lime, as before; and finiſh it with a layer of clay and ſea-weeds, covered with earth. The more of the ſlimy clay the better; for though it may be cold, yet will it not be the worſe for a ſandy hot ground. If you examine the clay, we doubt not but you will find it a very fat ſubſtance; being, as we conjecture, moſtly muſcle and other ſhells, mixed with earth brought by the tide and river Southeſk. On the coaſt of Lothian, we found that ſlimy ſubſtance to be nothing elſe; and if it be ſo with you, it is certainly one of the beſt manures.

"After this ſtercorary has ſtood ſix weeks, or

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* Cleaving is, when the turf is turned outward from the centre of the ridge. Gathering is the reverſe.

two months, incorporating and fermenting, turn and mix it; and that this may be done to the beſt purpoſe, at the leaſt expence, take your plough, and enter upon your ſtercorary with a cleaving furrow, and repeat the plowings the ſame way, until the very bottom of the ſtercorary be ripped up; then harrow it; it is impoſſible to overdo it. If it be very cloddy, it ſhould be harrowed between the plowings. Begin then in the middle, and plow again and again in the gathering way, until it be brought into as narrow bounds, and be raiſed as high as poſſible. Let all that the plough has left, be gathered up, and thrown with ſhovels on the top. Every ſuch turning and heaping occaſions a new ferment, and improves the manure.

"If the ſeeds of barley, or of any other quick-growing vegetable (ſuch as tares, or buck-wheat) were ſprinkled then on the ſtercorary, and the plants plowed in when fulleſt of ſap, before they come to ſeed; by turning or heaping again, the manure would be improved." This might be repeated ſeveral times in the courſe of the ſeaſon; for the practice has been found ſucceſsful.

In another place, the ſame Society obſerve, "that a ſtercorary may be turned in the ſame manner ground is trenched. The higher it is, the better. Each turning will make it heat like a garden hot-bed; and this fermentation will reduce it to a fine fat mould. If the firſt heat ſhould go off, which may eaſily be known by thruſting a pole into it, before it has produced this effect, it may be turned over again, and will take a new heat, which is of great advantage to it, beſides the better mixing of the ſeveral manures. About forty or fifty cart-loads of this manure are uſed upon an acre of ground."

I have been the more particular in extracting this account, becauſe any farmer, by attending to the rules here given, may ſuit his compoſt to the nature of his ſoil.

The well-preparing of mixed dung is, as Mr. Worlidge rightly obſerves, a piece of huſbandry by no means to be neglected: for the more and better the dung is, the greater will be the crop; and an increaſe of the crop will augment the quantity of the dung: on the contrary, a decay in the dung will make a decay in the crop.

ESSAY III.

Of the Manner of Cultivating Land.

SECTION I.

Of PLOWING.

HAVING before given an account of the qualities of different ſoils, and of the nature and effects of different manures, ſo as to prepare the ground for plowing to advantage; directions for this laſt become of courſe my next neceſſary ſubject.

Here would I gladly fix, by the example of the wiſe and judicious Romans, the huſbandman's particular attention, to this important article; by far the moſt eſſential of all the preparations which the earth undergoes. The ſententious Cato was fully convinced of this truth, when he laid it down as the firſt rule in huſbandry, to plow well;

the ſecond, to plow; and the third, to manure: thereby intimating, that plowing alone is of greater conſequence, than all the other means of cultivating land. When the ground is well plowed, he adviſes to plow again; meaning, that it is not poſſible to plow too often, or too much.

To ſow but little, and plow much, was a favourite maxim with thoſe conquerors of the world, who, next to the cares of government, made the culture of their lands the peculiar object of their attention.

Whilſt I beſtow this due encomium on plowing, I do not however mean to recommed it upon Mr. Tull's principles, "that dividing, and pulverizing the earth is all in all." I only mean to ſay, how uſeful, how neceſſary, how beneficial it is.

Previous to any directions for the practical part of plowing, it will be proper to mention thoſe ploughs, which are thought to be fitteſt for performing the buſineſs well. I ſhall avoid a profuſion of plates and explanations, being fully apprized how expenſive, and tedious they become. Some, however, of the neweſt implements, with which many of my readers may not be acquainted; particularly thoſe at a diſtance from the capital, I will here give, in order to explain, what otherwiſe might be perfectly unintelligible.

I think I may venture to ſay, that although ploughs are the moſt common of all the implements belonging to huſbandry, yet are they the leaſt perfect in their conſtruction, and their mechaniſm the leaſt underſtood.

We are favoured by Mr. Arbuthnot, with a very ingenious treatiſe on this ſubject; and I ſincerely wiſh it had been poſſible to give it in a more familiar, and leſs ſcientific form; for, as it now ſtands, I fear it will tend but little towards promoting, either the knowledge of plough-making, or of plowing. To it, however, I will refer thoſe gentlemen, whoſe mechanical information qualifies them to underſtand it; and to thoſe who do not poſſeſs that information, I will point out, as conciſely as I can, the objects of improvement which Mr. Arbuthnot has in view.

The firſt rule, which Mr. Arbuthnot lays down, is with reſpect to the line of traction, or draught, which, he juſtly obſerves, ſhould be a line drawn from the tug at the horſe's ſhoulder, to the point of the ſhare; which line ſhould intercept the notch in the copſe, immediately below the end of the beam. It muſt be obſerved, ſays Mr. Arbuthnot, that the tug at the ſhoulder of a full ſized horſe, is about four feet four inches from the ground; and the length of chains, neceſſary to work freely, about nine feet. But, as the line of draught will vary according to circumſtances; ſuch as the level of the ground the horſes go on, the nature of the ſoil to be plowed, &c. it will be found neceſſary to fix a copſe at the end of the beam, in order to raiſe or lower the draught, and to give the plough land, or not. The cat-head, uſed in Suffolk, is ſuperior to every other kind of copſe. Fig. 1. Plate I. is the cat-head, with the copſe fixed to it. Fig. 2. is the ſide view of the copſe belonging to the cat-head.

If two horſes are going abreaſt in the plough, the line of draught is ſimple, as above directed; only taking care that the ridger, or ſhort chain that goes over the horſe's back, does not raiſe the traces out of the ſtraight line, ſo as to form an angle, as at E, Plate II. All that the ridger ſhould do, is, to keep the traces from falling down among the horſes feet.

If the horſes go in length, their draught ſhould alſo be in a direct line from the copſe at the end of the beam, and not from the traces, or chains of the thill horſe, which increaſes the weight on his back, in proportion to the draught of the horſes that go before him.

By this method, it is evident, that the whole weight of the draught of the plough, would be ſupported by the thill horſe; the conſequence of which is, that he never puts his ſhoulder to the collar; learning by habit, that his ſhare of the labour is, to carry the weight, and that ſometimes ſo intolerable, as to make him reel in the furrow.

Plate II. repreſents a plough in its work, with the lines of traction.

AB is the beam of the plough, ſix feet long, having a copſe extending three inches beyond it, and eight inches deep.

The under part of the end of the beam at B, fourteen inches from the bottom of the furrow.

C, the point of the ſhare, two feet ten inches from the under part of the end of the beam at B.

D is the point of the horſe's ſhoulder, about four feet four inches high.

E is the angle, improperly made, by ſhortening the ridger.

As the perfection of the ſwing plough depends on ſo great a nicety, it is continually liable to be out of order. For example; if the point of the ſhare be made longer, or ſhorter, by new laying; or is ſet down either too deep, or not deep enough, the

Plate I.

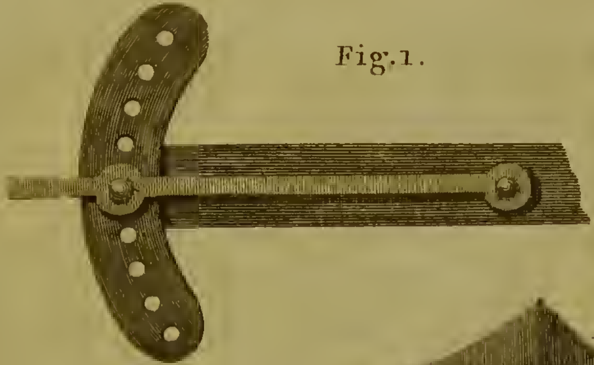


Fig. 1.

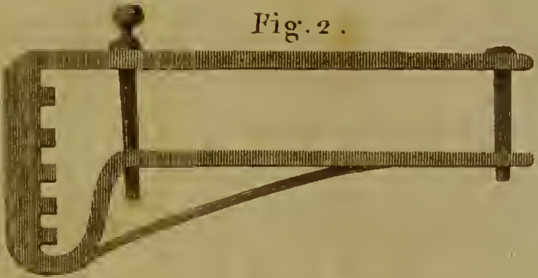


Fig. 2.

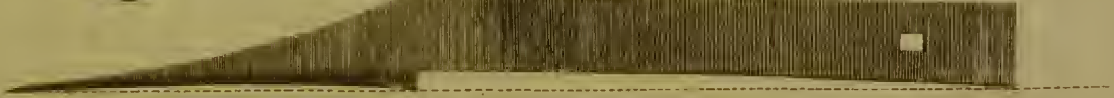
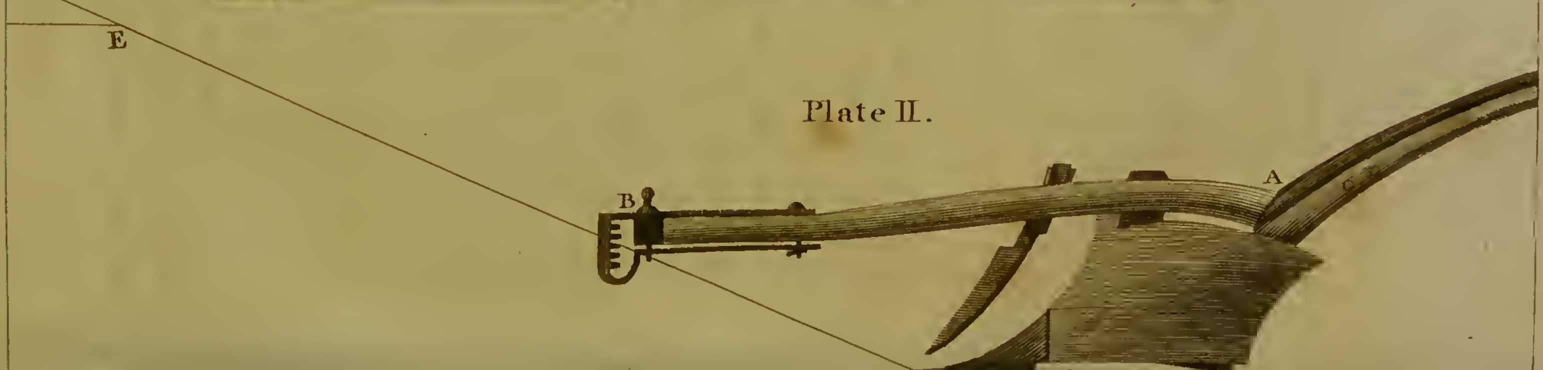


Fig. 3.

Plate II.



the plough will not go well. This, indeed, a ſkilful plowman will, in ſome degree rectify, by an alteration in the geers. The beſt method is, as mentioned before, by raiſing, or lowering the draught at the copſe; but if it requires ſo much alteration, that the depth of the copſe will not admit of it; the next beſt is, by lengthening, or ſhortening the traces, which will alter the angle of traction: and this ſhews, that the length of the traces ſhould be more attended to than it generally is.

The method Mr. Arbuthnot recommends, to prevent a ſhare from being altered from its firſt form, when ſent to be new laid, is, that the landſide of the ſhare be continued the whole length of the plough; and when applied to the pattern given to the ſmith, he has the complete form of the bottom of the plough, and can make no alteration; nor can the plowman ſet the point up or down, or in or out of land, the whole going on at once, and is fixed by a bolt at the heel. See Plate I. fig 3.

Mr. Arbuthnot's plough does not differ much from the Rotherham, from which he took the idea; but he made the breaſt of his plough elliptical, as the form beſt ſuited to cleave and raiſe the land. The bottom of the breaſt, where the buck of the ſhare joins to the board, he made as broad as could be admitted of. This, of courſe, is very flat, which, he was of opinion, aſſiſted in raiſing the furrow; being continued in a gradual ſweep to the heel of the board, which was not above half an inch wider than the fin of the ſhare. It muſt be here obſerved, that the bottom of the mould-board is an inch and a half from the bottom of the furrow; and, as the upper part of the heel of the mould-board hangs over ſome inches, if the line of inclination was continued to the bottom of the furrow, it would not be wider than the fin of the ſhare. In every other reſpect, Mr. Arbuthnot's plough reſembles the Rotherham, except in the fin of the ſhare, which is much broader: the breadth of the fin of his plough, which is the ſame ſize with the Rotherham, is full nine inches wide, and ſo in proportion to the ſize of the plough. This is contrary to general practice: but Mr. Arbuthnot was convinced by experience, that he was right.

His reaſon for trying the broad-ſhare was, that as the coheſion of the earth creates a much greater reſiſtance than its weight does, to the plough, he thought it beſt to cut the whole furrow he wiſhed to raiſe; whereas, the narrow fin cuts only a part, and leaves the remainder to be torn up by the wreſt of the plough. Some plowmen think this laſt circumſtance neceſſary to lay-land; and ſay, that if the ſhare cuts the whole furrow, it will ſlip away, and be ſet on edge; which is certainly the fact, when the mould-board and body of the plough are badly conſtructed; but when the proper ſweep of the board is obſerved, and care taken that the heel of the plough is not too wide, Mr. Arbuthnot aſſerts that the furrow will be turned over as flat as it is by thoſe ploughs that only cut a part of the furrow; which laſt circumſtance, of only cutting part of the furrow, is a confeſſed fault, and particularly in lay-ground, which has acquired a degree of coheſion, in proportion to the time it has been laid down to graſs. The objection of others is, that in ſtiff land the broad fin will ſuck into the ground; or that the plough will ride upon the fin, and be thrown out of its work: but he proved the contrary, to the conviction of his ſervants.

Mr. Arbuthnot was indeed very careful, that the fin ſhould not hang down below the point of the ſhare. His rule was, that the point of the ſhare, point of the fin, and heel of the land ſide, ſhould all touch a level ſurface, when the plough ſtands upright; forming an arc from the point of the ſhare to the heel at the bottom; and the ſame on the land ſide. See Plate I. fig. 3. This he did, becauſe the point and heel always wear the ſooneſt; and conſequently, without being hollowed, would ſoon become convex; after which the plough would not go ſteadily. For the ſame reaſon, he was likewiſe careful to have the ſhort ſide of the buck of the ſhare clear the ground by an inch: for if that ever touches the ground, it throws the plough out.

The next, and not the leaſt important part to be conſidered, is, the ſhape of the mould-board; about which people differ much in opinion, both as to the ſhape of the breaſt, and the ſweep of the board. Mr. Arbuthnot ſays, he paid great attention to this ſubject; the reſult of which was, that he ſaw many diſadvantages, and not one real advantage on the ſide of the ſtraight mould-board. In this, he had not only his own practice to confirm his opinion, but alſo that of neighbouring farmers, who frequently borrowed his ploughs, to break up ground, which they could not do with their own. This circumſtance, ſays he, is no ſmall proof of the preference due to the curved mould-board.

When a farmer has hit upon the ſweep of a mould-board that pleaſes him, and would have the ſame form preſerved in others, he may have a mould of it taken in plaiſter, and may have it thrown off repeatedly in caſt-iron, as light and as ſtrong as the wood mould-board; with this difference in its favour, that it will laſt much longer, and keep its form better. The Society of Arts had a plough preſented to them, wholly conſtructed of iron, which did its work well.

The ſwing-plough is a very good inſtrument, when well conſtructed: but as it is liable to be thrown out of its work by a ſlip of the ploughman's foot, which flings his weight upon the handles, or by a jerk of the horſes, which will elevate the point of the ſhare; it is an aukward tool to introduce into countries where the men are not uſed to it. Therefore, where the land is dry enough to be wrought flat, which will admit of the wheel-plough, it is greatly preferable; particularly where neceſſary to plow deep. And Mr. Arbuthnot is of opinion, that the draught is at leaſt as light, provided the proportion of ſizes is equal. He makes the bodies of both ploughs alike, with this only difference, that he then ſets the point of the ſhare more down. The carriage of the Norfolk plough ſeemed to him preferable to all others, on account of its high wheels.

I find in a minute of the Agricultural Committee of the London Society of Arts, that a comparative trial of ſeveral ſwing-ploughs was made by them in the year 1771; and that the preference was then given to one of Mr. Arbuthnot's, over the Rotherham, and others, both for the ſmallneſs of reſiſtance, and the depth, width, and cleanneſs of the furrows. This ſays much in favour of his ſuperior ſkill; when Mr. Ducket was one of the judges.

With regard to the Norfolk plough, which I juſt now mentioned, as approved by Mr. Arbuthnot, I have further to obſerve, that it has many good qualities on level land, which is free of ſtones. Its ſuperior advantages are, that it goes with two horſes only, without a plough-boy; in which way it will break up the ſtrongeſt level land, and go over more than half an acre a day. This plough has but one handle, which the ploughman holds in his left hand, carrying his whip in the other, and, when neceſſary, takes alſo the plough-line in it; whereby he directs his horſes to right or left, at pleaſure. Having but one handle, he, by ſtopping his horſes, and ſtepping one ſtep forward, can, in half a minute, raiſe or ſink his plough, in any direction he thinks neceſſary. This a good ploughman will do, in land that is very uneven, two or three times in a furrow.

Having but two horſes, and thoſe going abreaſt, he can always ſee between them; by which means, he draws out his work in a direct ſtraight line, and makes his furrows perfectly true.

It muſt, however, be obſerved, that this plough will not break up paſture land properly, to ſow on one earth*.

The beſt, I believe, that ever was thought of for this purpoſe, is a plough invented by the ingenious Mr. Ducket, of Eſher; where the coulter is ſo contrived, as not only to cut the turf, or flag, and lay it over, but the ſhare following after, completes the buſineſs, by raiſing an additional quantity of mould, and laying it over the flag; by which means there is a greater depth of ſtaple above it, which not only buries the weeds and graſs more thoroughly, but alſo gives a better opportunity of drilling the ſeed; the plough having more than ſufficient depth for its furrow, without interruption from the old ſwerd.

It was by this mode of practice that Mr. Ducket made ſome wonderful improvements on his farm at Ham: for by thus plowing a ſandy and light ſoil, and laying it a good depth over the ſod, or turf, as above deſcribed, he contrived to prevent his manure from being waſhed down beyond the reach of the roots of his plants; and by treating ſtiff clays in the ſame manner, and laying ſome light mould and manure over the ſtaple, he thus prevented the roots of his plants from penetrating into too cold a ſoil.

This plough appears to me of ſuch importance to the farmer, that I have here given a plate of it, taken from one I had from Mr. Ducket, and made under his direction. See Plate III.

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* Bath Soc. Tranſ. Vol. II. p. 356.

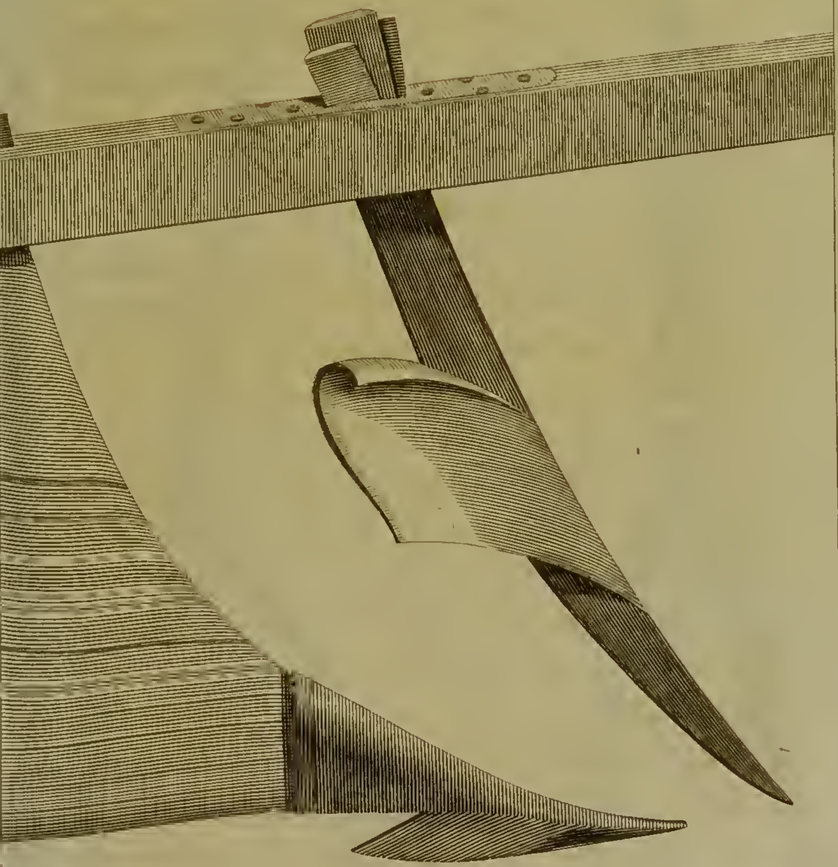
Nor can I omit mentioning here another plough, invented alſo by Mr. Ducket, who is a man of real genius; and a man of genius is always fertile in reſources. This implement appears to me ſo worthy of the attention of farmers, that I have alſo given a plate of it, drawn, as the former, from one in my poſſeſſion, which I had likewiſe from Mr. Ducket. See Plate IV.

This plough is intended for trenching of ſtubbles in autumn, without turning the turf, or flag, and without making a furrow. It ſlices off the ſurface three or four inches deep; by which means the ſtalks of the growing weeds are cut off ſo far under the ſurface, and the ſeeds of others are left upon the ſurface, and not buried in the ſoil, as they would otherwiſe be, were the flag turned over.

It is with great pleaſure I take this opportunity of likewiſe announcing to the public a new plough, which, from its model, promiſes much; and ſtill more from its author, the reverend Mr. Cooke, the ingenious inventor of a drill plough, now brought to the higheſt pitch of perfection, by his late improvements.

This new-invented plough is for general uſe, and

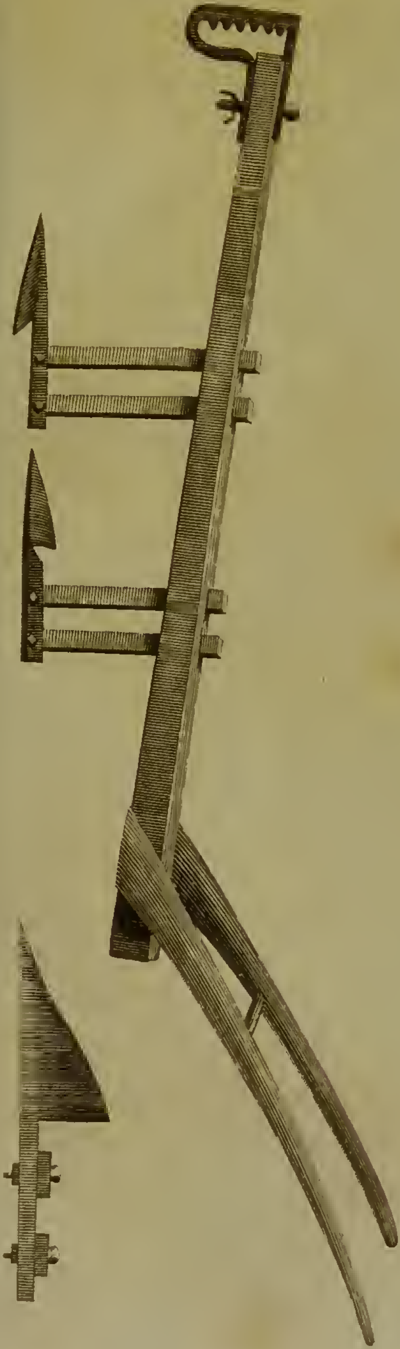
Plate III.

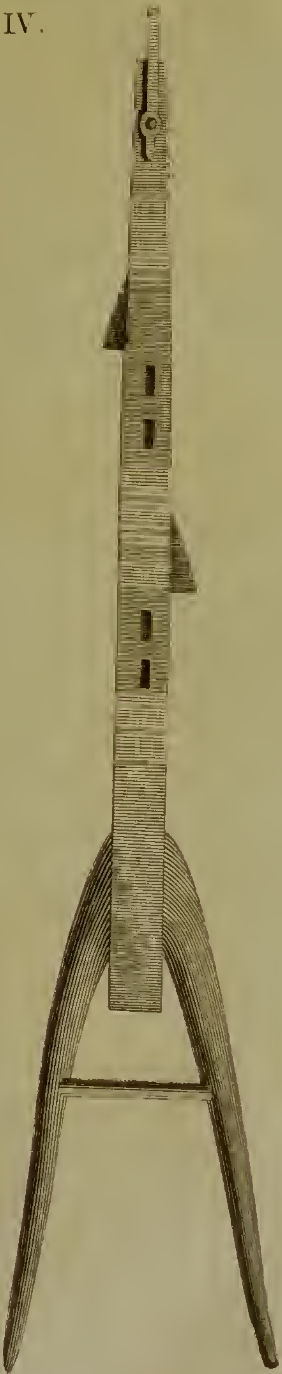


.Milne del.

J. Lodge sc.

Plate IV.





ne del.

J.Lodge sc.

and may be employed, like Mr. Arbuthnot's, either as a ſwing or wheel plough. It is propoſed to be made altogether of caſt-iron, except the handles, and has every appearance of anſwering its purpoſe well.

The beſt plough is certainly that, which is moſt ſimple in its conſtruction, and tackle; which requires the leaſt ſtrength to draw it, in proportion to the ſtiffneſs of the ſoil; which can be made to cut always to a proper depth, and cleanneſs; and which, by its mould-board, is beſt adapted to turn the furrow upſide down.

Experience is the only ſure guide in all matters of this kind ; but were I to judge from reaſoning, I ſhould certainly decide in favour of this new plough. The vaſt variety of ploughs now in uſe, through Great Britain, and Ireland, is to me a convincing proof, that none of them are perfectly good: for if any of them had a decided ſuperiority, it would be adopted univerſally. Such a plough, therefore, as Mr. Cooke's promiſes to be, is ardently to be wiſhed for.

In order to render this ſhort diſſertation on ploughs as uſeful as poſſible, I have here added a plate, and explanation, of the implement with which Mr. Arbuthnot performed all his operations of deep plowing for madder, &c. With this plough, he ſtirred no leſs than eighteen inches deep, with a team of eight or ten horſes; and performed the work in the beſt manner. See Plate V.

PLATE V.

					Feet.	In.	
From	1	to	2	—	10	0	
	1	to	3	—	3	2	
	3	to	4	—	2	8	
	4	to	2	—	4	0	
	5	to	6	—	1	8	
	7	to	6	—	1	2	
	6	to	A	—	1	2	
	7	to	8	—	2	1	
	8	to	9	—	1	7	
	9	to	10	—	2	9	
	11	to	12	—	3	3	
	7	to	10	—	2	10	
	13	to	14	—	3	0	but variable.
	4	to	15	—	3	0	ditto.
	13	to	15	—	3	0	
	16	to	1	—	5	0	

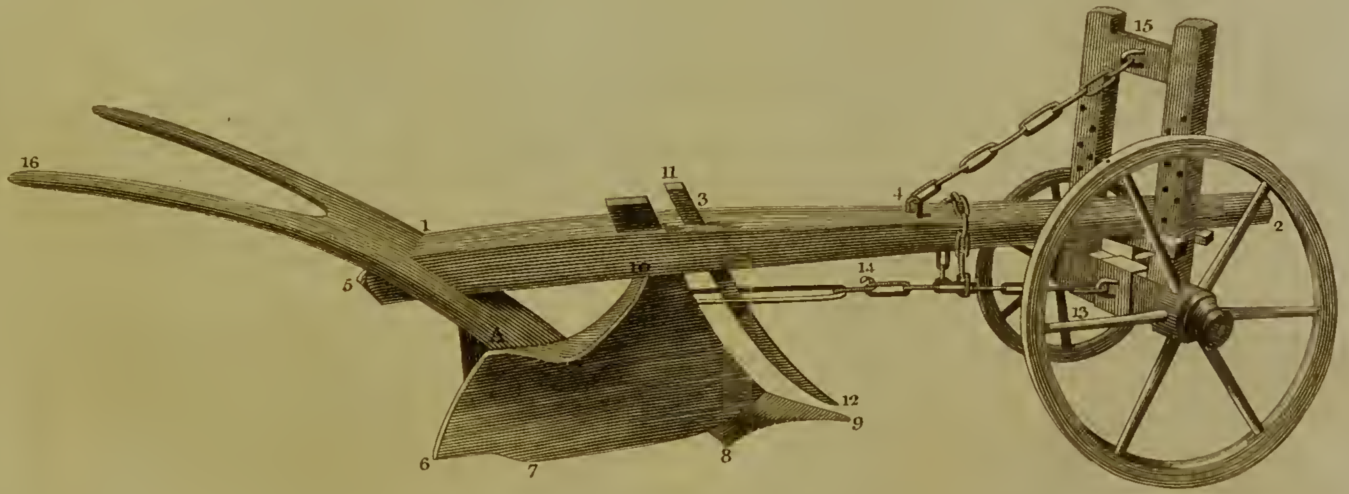
The gallows ſeventeen inches wide.

The beam ſix inches ſquare at the coulter-hole, rounded to three inches at the end.

Diameter of the ſmall wheel, two feet four inches; and of the larger, four feet.

I think it very material to obſerve, that in the above

Plate V.



T. Milne del.

J. Lodge sc.

above quoted minute of the Society of Arts, &c. they mention having made uſe of an inſtrument, for meaſuring the degrees of reſiſtance that the different ploughs overcame. That reſiſtance, they make equal to four, five, ſix, and at moſt, ſeven hundred weight.

This being the caſe, ſurely there can be little doubt of making two horſes perform the buſineſs on the ſtiffeſt ſoil, if the plough employed be really well conſtructed.

Plowing is the action of the plough, in ſtirring and turning over the earth. By opening the ſoil, and enlarging the ſurface, it not only gives it an opportunity of extracting the vegetable food from the air, from rains, and dews, and conſequently of increaſing the food of plants; but alſo, infallibly deſtroys any poiſonous qualities that may be in that ſoil, ariſing from metals or ſulphur.

Plowing alſo diſſolves, and reduces to a ſtate of putrefaction, the dung, and vegetable ſubſtances, that happen to be mixed with the ſoil; and prepares them for entering the roots of plants. When properly managed, plowing likewiſe deſtroys weeds, and drains the land when too wet, pulverizing the ſoil, and opening the way for the fibres of plants to go in ſearch of their food, thereby rendering them ſtrong, and vigorous. Hence, plowing is one of the moſt important

operations

operations in agriculture; and therefore deſerves the greateſt attention.

When plowing is deſigned to enrich the land, or diveſt it of any bad qualities, or increaſe the food of plants, the ſurface cannot be made too uneven; becauſe more of it is, by ſuch means, expoſed to the influence of the air. But when the principal intention of plowing is, to deſtroy ſeed-weeds, the ſurface cannot be made too ſmooth; becauſe, by this management, the vegetation is promoted, and conſequently they may be more completely deſtroyed by plowing them in. If the land is plowed, with a view to remove wetneſs, it muſt be laid up in higher ridges; for, the greater the number of furrows, and the higher the ridges, the water is the more expeditiouſly carried off.

Thus, the manner of plowing muſt always depend on the object in view. It frequently happens indeed, that two or more of theſe objects require our attention in plowing the ſame piece of land: but the methods above mentioned are perfectly conſiſtent with each other, and may be combined ſo as to anſwer every uſeful purpoſe.

In plowing, ſome general rules are to be obſerved, whatever be the object in view. Thus, land ſhould never be plowed when it is wet; becauſe the intention of it will be fruſtrated, whatever

ever be the nature of the ſoil. A ſtiff ſoil, when plowed wet, dries ſuddenly, and becomes hard. If a light ſoil be plowed wet, the water hinders it from being reduced to ſufficiently ſmall particles. Beſides theſe diſadvantages, the labour becomes ſevere on the cattle, and the land is much hurt by their treading*.

The depth of the furrow muſt, no doubt, be greatly regulated by the nature of the ground underneath. In ſtrong ſoils, the turf, or flag ſhould not be turned over too wide; becauſe the ſoil is not ſufficiently divided. The wideneſs of it ſhould be adapted to the ſtiffneſs, or lightneſs of the ſoil. A good width is about eight, or nine inches; but on light lands it may be more, unleſs where it is required to plow a great depth: for it is always neceſſary to proportion the width of a furrow to its depth, that the reſiſtance may be equal. Thus, a wide furrow ſhould have leſs depth, and a deep furrow leſs width, to make the draught equal to the cattle.

This ſuggeſts another error often fallen into by farmers; that of fitting the ſtrength of the plough to the ſtiffneſs of the land: as if it were abſolutely neceſſary, always to cut furrows equally wide, without regard to the nature, or quality of the ground. From this it happens, that a great thickneſs of the ſtrongeſt ſoil is often turned over ſcarcely broken by the plough, and the cattle labour hard to very little purpoſe: whereas, the furrows ſhould be ſo numerous, thick, and cloſe, that it may not be eaſy to diſcern which way the plough was drawn; for thus the roots of weeds are torn up, and killed.

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* To plow in ſnow is reckoned extremely productive of May-weed; beſides, ſnow plowed in, lies a great while under the turf, or flag, chills the earth, checks the roots, and prevents the ſprouting of the ſeeds, which ſhould be kept as warm as the ſoil and ſeaſon can admit of.

Deep plowing, where the ſtaple of the ground admits of it, will be of great ſervice to whatever corn is ſown in it: for the fibres of the roots, which are the mouths that ſupply the plants with nouriſhment, penetrate a great way into the earth. Mr. Miller has traced many of them upwards of three feet; and believes they ſpread much farther, when the ſoil is light. It is therefore of great importance, that the ground be well ſtirred, and looſened to a certain depth; for by ſuch means, the roots will find a ſupply of pabulum, for the nouriſhment and increaſe of the ears at the time they are forming, when it is moſt wanted: whereas, if it be plowed ſhallow, they will have reached the bottom of the looſened mould by the ſpring, and, not being then able to penetrate farther, the ſupply of food neceſſary for the ſtalks will at once fall ſhort. From this cauſe, we frequently ſee the colour of the blades of corn change in April: nor do they, often, recover their former verdure, unleſs they are helped by ſome top-dreſſing; and when this happens, the ſtalks are always weakened in proportion to the decay of the blades: for it is well known from long experience, that the leaves and blades of corn, and other plants, are neceſſary to draw in nouriſhment from the air and dews, for the increaſe and ſtrength of the ſtalk, ear, and other parts*.

A double-deep plowing may be ſometimes requiſite, to turn up freſh ſoil. This may be done by making the plough go twice in the ſame furrow, ſo as, with the help of a ſhifting mould-board, ſtill to turn the earth over to the ſame ſide. Or it may be done at once plowing, by ſuch an implement as Mr. Arbuthnot's wheel-plough, of which I have juſt now ſpoken: or, if ſuch an implement be wanting, by two ploughs, one following another in the ſame furrow. However, this ſhould be done with prudence, and ought not to be repeated too often, nor ſhould the earth be turned up in too great quantity: for new earth requires to be expoſed ſome time to the effects of the air, in order to its being fertilized. But it is not a leſs certain fact, that when it is done, into an earth not abſolutely unfruitful, it proves a kind of renewal of the whole ſoil, and gives it freſh vigour. Some people imagine, that new earth is barren, and hurtful to land: but experience will ſhew the contrary, if they conſider the practice of gardeners in digging their ground. It muſt, however, be allowed, that turning up a large quantity of freſh mould may be attended with ſome inconvenience the firſt year: for which reaſon it is beſt to give this deep plowing before winter, and not to ſow till the ſpring; taking for the firſt time a crop of oats, or ſome ſuch hardy grain*. Froſt has a peculiar virtue in breaking the clods, and looſening

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* They attract water from the atmoſphere, ſo as to nouriſh the plant totally; and the roots alſo throw out part of the juices into the ground.—Fordyce's Elem. of Vegetat. p. 75.

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* Deep plowing has great advantages in adding to the food of plants, by giving them a facility to puſh their fibrous roots to a greater depth than otherwiſe they could do. For roots in particular, ſuch as madder, carrots, parſneps, &c. it is abſolutely neceſſary to plow deep; as alſo for ſome artificial graſſes, ſuch as lucerne, in particular. At the ſame time, a large proportion of new ſoil certainly impedes vegetation for ſome years; from a too great mixture of what I call crude, cold, and inactive ſoil. To this cauſe, and to this only, can I aſcribe thoſe poor and unproductive crops which Mr. Arbuthnot reaped from land, otherwiſe in the fineſt condition; as I ſhall have occaſion to mention more particularly hereafter. To remedy this evil, had Mr. Arbuthnot given his land a good dreſſing of quick-lime, or calcareous marle, he would have effectually cured that crudity and ſluggiſhneſs, by the warm fermentation they would have created.

ing the earth*: from whence it follows, that to plow well before the winter, and to lay up the ſoil to its influence by ſingle plowing, or bouting, as it is called here, will prevent the neceſſity of deep plowing in the ſpring, and ſave labour in that buſy ſeaſon. Beſides, it is well known, that extraordinary advantages have been uniformly derived from plowing up ſtubbles immediately after the crops are carried: and many intelligent and experienced farmers have declared, that one plowing before winter is worth two or three in the ſpring. Mr. Ducket, whom I always quote as a firſt rate authority, does not, however, approve of a conſtant repetition of the practice, and prefers the ſlicing of his ſtubble lands, as I term it; becauſe, by cutting the ſtalks of weeds ſo much under the ſurface, and by leaving the ſeeds of others to rot upon the ſurface, he helps greatly to keep his lands cleaner: but this is not all; for he told me, that he found an advantage in not going always the ſame depth with the plough; taking ſometimes a crop from a more ſuperficial furrow, and at other times going deeper. This, on light lands, as Mr. Ducket's in general are, muſt, I am perſuaded, anſwer well. On heavy lands, which ſadden and grow together in the ſpace of one year, I am very doubtful of the ſucceſs of this, otherwiſe, ingenious thought.

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* Froſt, by the expanſive power of the chryſtallization of the water, breaks down the maſſes which form in ſtiff ſoils.

Of plowing, or breaking up new land, I have already ſpoken much at large in a former Eſſay.

When a ſummer's fallow is intended, it is infinitely the beſt way to bout it up in the preceding autumn, as ſoon as ſeed time will permit, particularly if it be a ſtiff ſoil; for it will thus become much more mellow, and tractable in the ſpring. It will then be right at that ſeaſon to take the earlieſt opportunity that a neceſſary attention to the Lent-crops will admit of, to give the fallow a ſecond plowing; ſplitting the bouts, and laying them flat. A harrowing ſhould then be given, to ſmooth the land, and collect the weeds, which ſhould be burnt on the field in heaps, and the aſhes ſpread. The third plowing ſhould be acroſs the former, harrowing again; and then by a fourth plowing, draw out the field into the ridges of the ſize that may be judged beſt for the ſoil and ſituation.

If this laſt mentioned plowing be given towards the middle or end of May, and there is a want of manure, a crop of buck-wheat may be ſown, at the rate of one buſhel, or five pecks to an acre. When this is in full flower, it ſhould be plowed in; let the land then lie for a month, when it ſhould get the ſixth and laſt plowing. After which, it ſhould be harrowed, and ſown in drills, and then buſh-harrowed, and rolled. This proceſs will inſure a good crop on very indifferent land.

It ſhould here be obſerved, that if it be intended to apply any corrective manure to alter the ſoil, it cannot be laid on too early in the ſummer; that it may be the more intimately mixed with the earth, by the repeated plowings. But if a compoſt for enriching the ſoil be uſed, it need not be ſpread till before the laſt plowing.

Where there is a proper deſcent for water, it is very unneceſſary to lay the ridges up too high, or to make them too narrow. I have always reckoned it the effect of prejudice, to lay up light ſoils into narrow ridges for wheat. And even in ſtiff ſoils, I can ſee no reaſon for loſing ſo much uſeful ſpace in innumerable furrows, when broader ridges may eaſily be raiſed a ſufficient height to ſhoot off the ſuperfluous water. For my own part, I am much inclined to think, that ridges of two, three, or four ſteps, are narrow enough for any purpoſe whatever: and perhaps wider ones on wet ſoils might be attended with inconvenience. I have always confined myſelf to theſe dimenſions, as thinking them moſt ſucceſsful. With reſpect to the direction of ridges in a field, I have already obſerved, that it is almoſt impoſſible to give any inſtructions, except this very general one, to lay them ſo as to make the furrows moſt uſeful for draining the ground; and to improve that plan by croſs furrows, traverſing the former, ſo as to receive the ruſh of water, and the ſoil it brings along with it. If the declivity be conſiderable, the croſs-furrows muſt be more frequent; and even after they are drawn with the plough, a labourer ſhould follow to clear them out with a ſpade. This is performed here at an halfpenny per pole, or even at three poles for a penny. Before this is done, the common ridge-furrows ſhould be ſlid out with a double mould-board plough, and a labourer ſhould follow with a ſpade, and throw the rough edges left by the plough into the centre of the ridge, breaking every clod, and rounding the edges as he goes. The whole field, thus carefully trimmed, takes the neat look of a well cultivated kitchen-garden.

In winter fallows, it is alſo neceſſary to provide means for the water to run off; otherwiſe, it renders the land extremely poachy, and unfit to work till late in ſpring.

If the ridges lie with the declivity, I have often plowed the field diagonally in autumn, to croſs the former furrows, and at the ſame time to preſerve the current for the water.

To prevent the increaſe of weeds, they ſhould be deſtroyed before their ſeeds are ripe: but that is not poſſible in lands that are plowed the common way; becauſe, as they grow intermixed with the corn, and ripen ſooner than wheat, their ſeeds ſow themſelves: neither can they be extirpated by reſting the land; for the ſeeds of ſome of them will remain ſound ſeveral years in the earth. If a field in which there are many poppies, or red weeds, as they are called in ſome places, be ſown with ſainfoin, ſcarce a poppy will be ſeen the ſecond year; but when the ſainfoin is plowed up, even at the end of nine years, the red weed frequently appears anew; which can hardly be owing to any other cauſe, than that its ſeeds have remained ſound in the earth during all that time; for very few of them, in proportion to the quantities which ſpring up, can have been brought from the neighbouring grounds, or in dung. This is confirmed by an experiment made by M. du Hamel. He ordered the earth with which a ditch had been filled fifteen or twenty years before, to be dug out, and ſpread upon a piece of plowed land. Several plants of different kinds from any that were in the field, ſprouted up in the place where this earth was laid. Conſequently, they were produced from ſeeds which had remained unhurt in the ground, during the fifteen or twenty years that the earth had laid in the ditch.

This is an important reaſon for plowing thoroughly all lands that are fallowed : for it is certain, repeated plowings will deſtroy great numbers of thoſe ſeeds that ſhoot up during the fallow. But the ſureſt way to complete their deſtruction is, to continue plowing while the corn grows; though this can be done only in the new huſbandry, and is one of the many advantages which attend that far ſuperior mode of cultivation.

Weeds may be divided into four different claſſes. 1. Such as have creeping perennial roots; 2. Such as grow in cold wet ſoils; 3. Such as are of a large ſucculent body; and 4. Such as, having ſmall ſeeds, or ſeeds which ripen before the corn, ſow themſelves. Each of theſe requires a different treatment.

The firſt are moſt eaſily deſtroyed by ſummer-fallowing, by which their roots are cut and turned up to be withered by the ſun and air, after which they are dragged out by the harrows, and ſhould then be burnt. This, repeated as often as conveniently can be, eſpecially during a dry ſeaſon, will ſcarcely fail to have the deſired effect.

Colts-foot, which is propagated by the root, and is a very pernicious weed, may alſo be deſtroyed by ſowing the ground with rye-graſs, or any plants, which, coming up early in the ſpring, ſhade and ſmother it; for this will kill it in a few years.

The ſecond kind are deſtroyed by draining the earth of its ſuperfluous moiſture, and by manuring it with lime, aſhes, gravel, ſhelly ſea-ſand, and other proper correctives before mentioned for ſuch ſoils.

The third are extirpated by cutting them down when in full ſap and vigour; for the ſap being thereby interrupted in the courſe of its circulation, ſtagnates in the roots, and putrefies there. A few weak lateral ſhoots may be made; but if they are likewiſe cut in the ſame manner, the roots will putrefy entirely, by degrees, and, inſtead of hurting, will become a manure.

The fourth claſs, like the firſt, can only be deſtroyed by frequent fallows, and conſtant cutting, or rather plowing them down before they run to ſeed. Some, for inſtance the wild oats, may be mowed for hay; but it is much more beneficial to the land, to plow them in; becauſe, by ſuch means, inſtead of being exhauſted by frequent crops, it is manured by thoſe enemies of uſeful grain.

A good dreſſing of quick-lime, plowed into the land during a fallow, at the third or fourth plowing, is perhaps as powerful and as effectual a remedy, as any, againſt every ſpecies of weeds.

Banks and hedges ſhould be carefully kept free from weeds; not only to preſerve and improve the hedges, but alſo to prevent the ſeeds of weeds from being carried by winds into the adjacent fields; by which means the corn would be perpetually infeſted with them: and, as I before obſerved, theſe weeds collected may be uſefully employed.

SECTION II.

Of SOWING.

WHEN the earth is properly prepared for ſowing, the next moſt eſſential points to be conſidered are, Firſt, the choice of the ſeed. Secondly, the preparation of that ſeed. Thirdly, the time of ſowing. Fourthly, the manner of ſowing. Fifthly, the change of crops. Sixthly, the change of ſeed. I ſhall treat of each of theſe in their order.

ARTICLE I.

Of the Choice of Seed.

THE choice of the ſeed intended to be ſown, is an object of greater importance than many farmers ſeem to imagine. It is not ſufficient that the fineſt grains be choſen for this purpoſe, unleſs they be likewiſe very clean. Such ſeed is not difficult to be got from land cultivated according to the principles of the new huſbandry: but we ſeldom find corn free from the ſeeds of weeds, when it has been raiſed in the common way.

It is natural to ſuppoſe, that the grains of ſtunted and ſickly corn neceſſarily partake of the weakly diſpoſition of the plant which produced them, and that their productions cannot be ſo fine as thoſe which grow from the ſeeds of ſtrong and healthy plants. For this reaſon, Mr. Tull adviſes, to take the ſeed-corn from a richer ſoil, than that in which it is to be ſown; and rather from that in perfect tilth, than from land which has been leſs carefully cultivated. Dr. Fordyce ſeems to be of the ſame opinion, when he ſays, ſeeds taken from plants in a rich ſoil branch out more than thoſe taken from plants in a poorer ſoil. This appears rational: and though the contrary opinion is almoſt generally received; yet more may reaſonably be expected from the productions of fine good ſeeds, which are full of vigour, and well conditioned, than from poor, feeble, ſhrivelled ſeeds.

M. de Chateauvieux, who often ſowed with no other intention than merely to try, for the benefit of mankind, at what time, in what manner, and in what condition, it is beſt to ſow wheat; found that this corn ſprouted pretty well, even when ſowed ſo green, that it had not yet loſt its milky quality; but at the ſame time he thinks it more adviſeable to ſow none but what is thoroughly ripe; becauſe the ſeed has then attained its full perfection, from whence the beſt and ſtrongeſt plants may moſt certainly be expected.

The wheat which had been reaped in a warm dry ſeaſon, ſeemed to him fitter for ſowing, than that which had been gathered in a cold wet ſeaſon: for in ſuch a time as this laſt, all the productions of the earth are leſs good, their taſte is leſs ſavoury, and as that corn in particular, in which there is moſt moiſture, is moſt difficult to keep, it is from thence inferred, that the formation of its grain muſt be leſs perfect. Wheat a year old would therefore be preferable, provided the year it was gathered in was warm and dry; nor is it ſo ſubject to ſmut, as that which may have juſt been reaped in too rainy a ſeaſon: and wheat of the growth of high ground, ſeems preferable to that of flats. The benefit accruing from all this care may not be extremely great, but it coſts nothing. Let us therefore do in agriculture, what is done in all manufactures, where the ſmalleſt ſavings are not neglected. Small articles, often repeated, make large ſums in the end, and are a real gain.

Another circumſtance of conſequence was firſt diſcovered by chance by M. Chateauvieux, and was confirmed by repeated experiments, always attended with equal ſucceſs. In his experimental ſowings, he commonly uſed wheat taken from the heap in the granary, and ſometimes corn picked out of the ears, the moment before it was ſown. He counted the number of grains, of both ſorts, and found a very conſiderable difference in their productions. What was picked out of the ears, always roſe extremely well; ſcarce a grain ever miſſed; whereas, numbers of thoſe taken from the heaps, never ſprouted at all. He did not perceive this difference at firſt, but at laſt it ſtruck him; and he relates the fact, without pretending to account for it. The experiment itſelf may be of real uſe, by ſhewing, that inſtead of threſhing the wheat intended for ſeed, at any time, it ought not to be threſhed till within a few days of its being ſown. This may eaſily be accompliſhed, at little or no extra-expence.

Perhaps too this practice may be attended with another very valuable advantage. Threſhing the ſeed juſt before it is ſown, may poſſibly prevent the cauſe of ſmut in wheat: that is to ſay, that the wheat which has never been mixed with ſmutty corn, or any way infected by its black powder, will be exempt from that diſtemper. Not that the black powder is abſolutely the original cauſe of this diſtemper; but it is ſurely capable of communicating it to grains which are ſound.

Dr. Fordyce ſeems poſitive, that the ſmut is an inſect, which, he ſays, is not deſtroyed by drying, but revives upon being moiſtened; and if ſown with the ſeeds, will be propagated over the whole field.

Great care ought to be taken in threſhing the corn with flails on the barn-floor; for a large number of grains are frequently ſo much bruiſed thereby, that it is impoſſible they ſhould ever grow. If the wheat thus threſhed for ſeed be not thoroughly hard, and dry, the miſchief is ſtill greater.

As ſowing in drills requires much leſs ſeed than what is uſed in the common way, a new manner of threſhing it might be propoſed, by fixing up, at a proper height from the barn-floor, an implement like a hay-rake, but with ſhorter teeth. Let a man, unbinding a ſheaf, take handful by handful, and comb it through the fixed rake; when the firmeſt and ripeſt, and drieſt of the grains will fall firſt; and, being well cleanſed, and winnowed, would make a moſt choice ſelection for the ſeed. The ſtraw not yet completely emptied, ſhould be threſhed in the common way, for ordinary uſes. This operation may be compared to the making of wine, where the firſt running is always the beſt, and higheſt flavoured.

ARTICLE II.

Of Preparing the Seed.

THE uſe of Steeps was introduced very early into huſbandry; not only as the means of preſerving corn from ſeveral diſtempers to which it is ſubject, but alſo with a view to render the ſeed more prolific. That ſome of them have anſwered the former of theſe intentions, ſeems to be pretty well aſcertained, and very generally believed in this country; but with regard to the latter, much clearer and oftener repeated experiments than have yet been made, are ſtill wanting to confirm their boaſted efficacy.

I ſhall not enter into any detail of all the abſurd *recipes* publiſhed, for effecting theſe deſireable purpoſes; nor encroach on the reader's time with the tedious account of their great ſucceſs, or the experiments made to prove their inefficacy.

I ſhall content myſelf with laying before him two or three of the ſimpleſt and moſt approved methods; the firſt of which I have always followed, and have generally found it ſucceſsful.

Beſides the preventing of diſtempers, there are other advantages which attend the ſteeping of grain; as it affords a new opportunity of getting rid of defective ſeeds, and other rubbiſh, by ſkimming off what riſes to the ſurface of the lye. It alſo moiſtens the grain, and ſoftens its ſkin, which enables it to ſprout the ſooner in dry weather; and laſtly, I flatter myſelf, that by my method, it is leſs ſubject, when ſown, to become the prey of birds, and of inſects.

A large tub is filled with clean water, near the bottom of which a hole is pierced, for introducing a ſpigot and foſſet to run off the water, or lye. I then take a box, that will hold about four buſhels, with a wire bottom like a ſieve; and putting into it two buſhels of grain, it is plunged into the water, and the grain well ſtirred about with a wooden ſhovel. When any light grains riſe, they are ſkimmed off repeatedly, till no more appear. This water is then let to run off, and carry with it any filth, or impurities, which may have ſubſided, during the ſtirring. The caſk is again filled with freſh water, and to this is added as much ſea ſalt as, with a ſmall proportion of nitre, will make a lye ſtrong enough to ſwim an egg. The box and grain is now plunged into this lye, and being again ſtirred and ſkimmed, is left to ſteep for twenty-four hours; when the lye is let off. In the mean time, there is prepared on the floor, a parcel of quick-lime, coal-ſoot, and wood aſhes, of each equal parts, and all ſifted together through a fine ſieve. In this the moiſt grain is mixed, and turned over and over, till it is quite dry, with the powder adhering to it, and is then fit for uſe. The powder which adheres, being both hot and bitter, prevents the inſects from preying upon it; and I am of opinion, that even the birds have been ſhy of picking, after they had once taſted it.

I have heard aſſafœtida mentioned as a moſt effectual ingredient in ſteeps; no bird and no inſect daring to approach where the ſmell of it prevails: nay, it is even ſaid, that to the latter it proves altogether poiſonous. This information I received too late to make trial of it in the ſeed ſowed this ſeaſon (1788).

The Author of the New Syſtem of Agriculture, I obſerve, recommends a ſteep not much unlike the above mentioned. Take, ſays he, the corn intended for ſowing, and throw it, by a buſhel at a time, into a large veſſel full of water: let a man ſtir it with a ſtaff, as violently as he can, for a conſiderable while together, and then, giving it a little time to ſettle, ſkim off all that ſwims upon the ſurface: repeat this till no more riſes; then take out the corn which has ſunk to the bottom, and lay it by for ſeed; proceeding in the ſame manner till you have your intended quantity. After this, make a brine of bay-ſalt and rain water, ſtrong enough to bear an egg. Steep the ſeed-corn in this liquor thirty hours; for leſs time will have no effect: then take it out, ſpread it on a ſmooth floor, ſtrew over it a good quantity of fine powder of ſlacked lime, and ſweep the whole up and down, till each grain leaves clinging to another, and becomes, as it were, perfectly candied with the lime. It is then fit for ſowing; and will, ſays our author, infallibly produce a very abundant crop. I am, however, of opinion, that in omitting the wood aſhes and coal-ſoot, to mix with the ſlacked lime, he omits two very uſeful ingredients, in which I have great confidence, for the reaſons before aſſigned. Coal-ſoot is not only uſeful as a bitter, but alſo from its being ſtrongly charged with a neutral ſalt; and hence its utility in the making of ſal-ammoniac. Some farmers vary this laſt ſteep, by adding to it a mixture of pigeon's, or other dung; and in moſt parts of France, where this recipe is known, they omit the ſalt, perhaps becauſe it is there too dear; inſtead of which they ſteep the ſeed in lime-water. For this purpoſe, they put it into baſkets, and carefully ſkim off what ſwims at top; moſt of which would not ſprout, and is only fit to feed fowls. The ſalt, however, ſeems to me ſo very important an article, that it ought on no account to be diſpenſed with; for that is ſuppoſed, and with great probability, to be the principal preventive of ſmut in wheat.

In America, their recipe for preventing Indian corn from being plucked up by the crows and other birds, is as follows. Take the roots of ſwamp hellebore, known alſo by the ſeveral names of ſkunk cabbage, tickle weed, and bear's root; boil them in ſo much water as to keep them covered an inch deep: by two hours boiling, the liquor will be of ſufficient ſtrength; ſtrain it off, put your corn in it while the liquor is warm, and let it ſteep twenty hours. It will then be fit for planting. This is found to be an effectual ſecurity; for trials have been made with ſteeped and unſteeped corn in the ſame field, and the event has been repeatedly, that the birds have avoided pulling up the ſteeped corn, and have not ſpared the other. I mention this as a cheap article, which proper experiments might perhaps make uſeful in this country.

There is another ſteep ſtill more ſimple than any of the former, which has been uſed for barley by a correſpondent of the Bath Society*, who recommends it from experience. The ſpring being remarkably dry, he ſoaked his ſeed barley in the black water taken from a reſervoir, or pond, which receives the drainings from the dung-heap and ſtables. As the light and faulty grains floated at top, he ſkimmed them off, and let the reſt ſteep twenty-four hours. When the water was drained off, he mixed the ſeed with a quantity of ſifted wood aſhes, ſufficient to make it ſpread equally. He ſowed from the 13th to the 16th of April, and reaped ſixty buſhels per acre, of good clean barley, free from ſmut, or green corn, or weeds.

Several other fields, ſowed without preparing the ſeed, produced only twenty buſhels per acre, very much mixed with green corn, and weeds, when harveſted. This experiment merits the attention of every farmer: but I ſtill feel a partiality to the lime and ſoot of my own recipe.

ARTICLE III.

Of the Time of Sowing.

WRITERS of different countries mention the uſual ſeaſons for ſowing their ſeveral kinds of grain, without taking notice of any natural ſign, by which the huſbandman may be directed, when to ſow his corn with the greateſt chance of ſucceſs. For a rule of this kind, we are indebted to the juſtly celebrated Linnæus. Mr. Harold Barck of that ſchool, in his diſſertation on the foliation of trees, taking the hint from his great maſter, adviſes the prudent huſbandman to watch with the greateſt care, the proper time for ſowing; becauſe this produces plenty of proviſion, and lays the foundation of the public welfare of the ſtate, and the private happineſs of the people. The ignorant farmer, tenacious of the ways and cuſtoms of his anceſtors, fixes his ſowing ſeaſon generally to a month, and ſometimes to a particular day, without conſidering whether the earth be prepared to receive the ſeed: from whence it frequently happens, that the fields do not return what might be expected. The wiſe œconomiſt ſhould therefore fix certain ſigns, whereby to judge of the proper time for ſowing. We ſhould for this end obſerve in what order every tree puts forth its leaves, according to its ſpecies, the heat of the atmoſphere, and quality of the ſoil. Afterwards, by comparing together the obſervations of ſeveral years, it will not be difficult to define from the foliation of trees, if not certainly, at leaſt probably, the time when annual plants ought to be ſown. It will be likewiſe neceſſary to remark, what ſowings made at different times of the ſpring produce the beſt crops; that, by comparing theſe with the leafing of trees, it may appear which is the moſt proper time for ſowing. Nor will it be amiſs in like manner to note at what times certain plants, eſpecially the moſt remarkable in every province, blow; that it may be ſeen, whether the year makes a quicker, or ſlower progreſs. In upland, the ſowing of barley nearly coincides with the foliation of the birch. I am perfectly convinced, that great improvements might be made on the proper ſeaſons of ſowing, by a ſtrict inveſtigation of the above-mentioned phenomena.

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* Bath Soc. Tranſ. Vol. III. p. 326.

Mr. Stillingfleet was told by a farmer in Norfolk, that when the oak catkins begin to ſhed their ſeed, it is a proper time to ſow barley. Other trees may ſerve to direct the farmer, with regard to other ſeeds. The prudent gardener never ventures to put out his green-houſe plants, till the mulberry leaf is of a certain growth.

There is a wonderful coincidence, which probably takes place in all countries, between vegetation and the arrival of certain birds of paſſage. Linnæus ſays, that the wood anemone, in Sweden, blows from the arrival of the ſwallow; and Mr. Stillingfleet finds by a diary which he kept in Norfolk for the year 1755, that the ſwallow appeared there on the 6th of April, and the wood anemone was in bloom on the 10th of the ſame month. Linnæus obſerves, that the marſh-marygold blows when the cuckow ſings; and Mr. Stillingfleet finds by his diary, that the marſh-marygold was in bloſſom on the 7th of April, and the cuckow ſung the ſame day.

A due temperature of the ſeaſon, with reſpect to heat or cold, drought or wet, for all theſe greatly influence the ſtate of the earth, is eſſentially neceſſary, and ſhould be carefully attended to by the huſbandman when he ſows: but the preciſe time moſt proper for this work cannot be invariably fixed, becauſe it will always depend on the concurrence of a variety of circumſtances. The ſeaſons are more or leſs forward, and the ground is more or leſs dry, in ſome years than in others. A proper ſeries of well-made obſervations would furniſh the beſt of rules in this reſpect; but could not fix the time of ſowing to any particular day, or week. Whoever has any knowledge of the practical part of farming, muſt be aware that many untoward circumſtances often occur, to prevent the moſt attentive huſbandman from accompliſhing what he knows is beſt, and moſt to his own advantage. If, therefore, a proper ſeaſon for ſowing were preciſely aſcertained, the huſbandman would require a certain latitude, either before or after that ſeaſon, or perhaps both, in which he might perform the work.

I ſhall therefore only obſerve, that, in general, it appears to me better to ſow too early than too late; which laſt I think a very common fault in this part of the country. By early ſowing, the plants are better able to reſiſt the ſeverity of the winter, after they have acquired a certain degree of ſtrength; and their roots being then longer, and better fixed in the earth, they will be leſs liable to be thrown out by froſt. It follows from this, that the colder the climate and ſoil, the earlier the wheat ſhould be ſown. Moiſt lands are extremely apt to ſwell greatly in hard froſts, and, ſubſiding again in a thaw, leave the roots of plants quite bare upon their ſurface.

There have, indeed, been years in which fields ſowed very late, for inſtance, in December, have done extremely well: but that ought not to be made a rule, as experience ſhews ſuch late ſowings rarely anſwer. On the other hand, the corn is likewiſe expoſed to ſome dangers when ſowed too early: for inſtance, broad-caſt ſowing on a ſtrong ſoil may be greatly injured by rains falling, followed by a long drought in September or October, which will parch the ſurface, and impair the growth, or may, perhaps, even prevent the corn's riſing through ſo hard a covering. This misfortune does not extend to drilled corn, which may be relieved by hoeing. There is alſo another danger in favourable ſeaſons, that the ſtalks which ſhoot up before winter, cannot bear hard froſts, though wheat would not be hurt by them, when only in the blade.

M. de Chateauvieux, than whom we cannot have a better guide, is clearly of opinion, that, though the proper time of the year for ſowing be come, the corn ſhould not be put into the ground, if the temperature of the ſeaſon be not favourable; but that, on the contrary, the ſowing it ſhould be deferred, in hopes of a change. If, ſays he, the weather is very hot, and the earth extremely dry, it will be abſolutely neceſſary to wait till ſome rain has fallen; for otherwiſe the ſeed will riſe very imperfectly. This he was ſure of, from ſeveral experiments he had made, which contradict the common ſaying of farmers, that the earth is the beſt granary to keep corn in.

From the whole of the obſervations I have been able to make, I believe it will be found, that the beſt ſeaſon for ſowing of wheat in this country, is from the end of Auguſt to the end of October, watching the favourable opportunity of a friendly moiſture.

I muſt not, however, omit to mention, that ſix pecks of ſeed ſowed in September, are equal

to

to eight ſowed in October. Thus, from the end of Auguſt to the end of October, add half a peck of ſeed for every fortnight loſt.

The ſame rule may be applied to the ſowing of winter thetches, or tares.

ARTICLE IV.

Of the Manner of Sowing.

IT is of the greateſt conſequence to farmers, that every ſeed be placed in the earth at a proper depth, and in ſuch manner as will beſt inſure its growth. But experiments are yet wanting to determine with preciſion, what is the depth which beſt ſuits each kind of grain in different ſoils.

The method which Mr. Tull propoſes is a very good and eaſy way to aſcertain this point, where the depth can be regulated by the mode of ſowing. But ſowing broad-caſt does not admit of ſuch regulation.

Take, ſays Mr. Tull, twelve ſticks, or gauges; bore a hole in one at the diſtance of half an inch from the end, in the ſecond at an inch, and ſo on, increaſing half an inch to each of the twelve ſticks. Drive a peg into each of theſe holes; then, in the ſame ſort of ground as you intend to plant, make a row of twenty holes with the half-inch gauge;

put therein twenty good ſeeds; cover them up, and ſtick the gauge at the end of the row; then, do the like with all the other eleven gauges. This will determine the depth at which moſt ſeeds will come up; and the drill, if that inſtrument be uſed for the ſowing, muſt be ſet accordingly.

Upon the ſame principle, M. du Hamel dug a trench twelve feet long, ſloping it gradually from the ſurface at one end to the depth of two feet at the other. He then ſowed different ſeeds in this trench, and having put the earth in its former place, obſerved, firſt, that hardly any ſeeds riſe when buried deeper than nine inches; ſecondly, that ſome ſeeds riſe extremely well at the depth of ſix inches; and thirdly, that other ſeeds do not riſe at all, when they are above one or two inches deep. Experience ſhews, that the ſame ſeeds may be ſown deeper in a light, than in a heavy, ſoil; that grains which lie too deep in the earth to ſpring up in a dry year, may riſe in a warm and moiſt ſeaſon; and that others which are buried ſtill deeper in the ground, will ſometimes remain there, ſound and unaltered, for ten or twenty years; at the end of which time they will vegetate, and produce their proper plants, if they chance to be brought to the ſurface by moving the earth, as was mentioned before.

This, however, proves, that even the moſt hardy and moſt durable ſeeds cannot vegetate, when buried ſo deep as to be altogether deprived of air; an element as neceſſary for the vegetation of plants, as for the reſpiration of animals. This is one of the many circumſtances which render the new huſbandry ſo much ſuperior to the old, that by regulating in a great meaſure the depth of the ſeed, it is not deprived of its neceſſary ſupply of air; which is undoubtedly the cauſe of much loſs of ſeed in the broad-caſt way, eſpecially by what is called plowing in.

An ingenious friend of mine carries this ſo far, as to think, that grain ſhould not be buried at all, but be allowed to lie upon the ſurface, where it would ſtrike root and vegetate with vigour. Nature, ſays he, never buries her ſeeds, and yet they ſtrike root, and thrive admirably. However plauſible this may ſeem at firſt ſight, I believe it would be found very fallacious upon experiment; becauſe the firſt and ſecond ſets of roots are formed at ſome depth under the ſurface of the earth: and beſides, a field ſowed in this way, and left expoſed to the injuries of the weather, and the depredations of birds and inſects, would, I am perſuaded, make but a poor return to the huſbandman.

The uſual way of ſowing in broad-caſt is ſubject, in a great degree, to all the inconveniencies I have juſt enumerated. Much of the ſeed becomes the prey of birds and animals, or is ſcorched by the heat of the ſun, or rotted by the ſoaking rains. Beſides, the ſeed is often very unequally ſowed, by unſkilful ſowers, and falls thick in hollows, where the ſurface of the ground is unequal.

Senſible of theſe diſadvantages, farmers have, eſpecially for their winter grain, adopted the method of ſowing under furrow; that is, ſowing one half of the ſeed in broad-caſt, and then plowing it in, and afterwards ſowing the other half, which is covered by harrowing. But this method is alſo liable to almoſt as many objections as the former; for the quantity ſown in each particular ſpot, and the equal diſtribution which ought to take place throughout the whole, cannot but be ſtill more uncertain, than in the broad-caſt way, where the whole is ſowed at once; nor dares the farmer, in this ſowing under furrow, to omit ſowing the ſecond quantity; leſt great part of what has been plowed in, be buried ſo deep, that it cannot riſe, eſpecially if the ſoil be ſtrong. Another general fault in the common ways of ſowing, is, that too much ſeed is employed; partly becauſe cuſtom has eſtabliſhed a ſort of rule in that reſpect, and partly on account of the allowance which it is neceſſary to make for what the birds eat, and for what lies too deep ever to riſe; circumſtances, by which a very great quantity of corn is abſolutely loſt.

Much the beſt way, in my opinion, of ſowing without the drill, and by which ſeveral of the above mentioned inconveniencies are remedied, is, to plow the land in ſmall furrows the laſt time, and to have a ſower follow the plough, and ſtrain in the ſeed: after him follows the ſhort-tined harrow, and covers it over. With practice, this may be done to great perfection, and comes neareſt of any thing to the admirable method of drill-ſowing.

But this laſt method, whenever the inſtrument is good, is ſtill preferable to ſtraining in; becauſe it keeps more equal to a depth, and to the regular diſtribution of the ſeed. Beſides, when it is ſo contrived as to ſow ſeveral rows at a time, it is more expeditious, and conſequently leſs expenſive. It has already been obſerved, that, by the uſe of this inſtrument, great ſaving is made in the ſeed. The ſmallneſs of the quantity of ſeed is alſo the cauſe of our being able to chooſe that ſeed with greater care, and to prepare it with more attention: for this additional labour becomes light, where the quantity required is comparatively ſo very inconſiderable. Thus every advantage ſeems to be in favour of the new huſbandry; which is, in fact, nothing more than extending that kind of culture to the field, which was formerly confined to the kitchen-garden.

The two firſt inventions for ſowing in this manner, were Mr. Worlidge's drill-plough, and Don Joſeph de Lucatello's ſembrador, both of which may claim the merit of being originals. So many, and ſuch uſeful improvements have been made in theſe implements of late years, that it would be unneceſſary to enter into any deſcription of thoſe now obſolete inventions.

Of all the inſtruments I have yet ſeen, for performing this very uſeful operation, none has hitherto appeared to me near ſo perfect as Mr. Cooke's patent machine, which is now very much ſimplified, and improved, is generally known, and its merit as generally acknowledged. I do not, however, mean to ſay, that his invention may not yet be further improved; I hope it will, and ſhall rejoice to ſee it take ſtill further ſtrides towards perfection.

To this drill-plough, in its improved ſtate, Mr. Cooke has added a horſe-hoe, on an admirable conſtruction: I have therefore given a plate, and particular deſcription of both thoſe implements, which is moſt obligingly furniſhed to me, by the very ingenious inventor himſelf.

Explanation of the Rev. Mr. COOKE's *Patent Drill Plough,* Plate VI. fig. 1.

AA ſhafts of the machine, applied to the axis of the wheel.

BB is ſo contrived, that the horſe may go in the furrow, without ſetting a foot upon the land, either for the purpoſe of drilling, or horſe-hoeing; which is found very advantageous, when land is ſo ſoft as not to carry a horſe without poaching; alſo in repeating the horſe-hoeings, when the crop is otherwiſe too high, to admit of his going among the corn. By means of the horſe going in the furrow, hoeing may be performed when the crop is beginning to ſpindle for going into ear.

CC coulter-beam, with holes, or mortices, at different diſtances; by which means the diſtances of the drills may be varied at pleaſure.

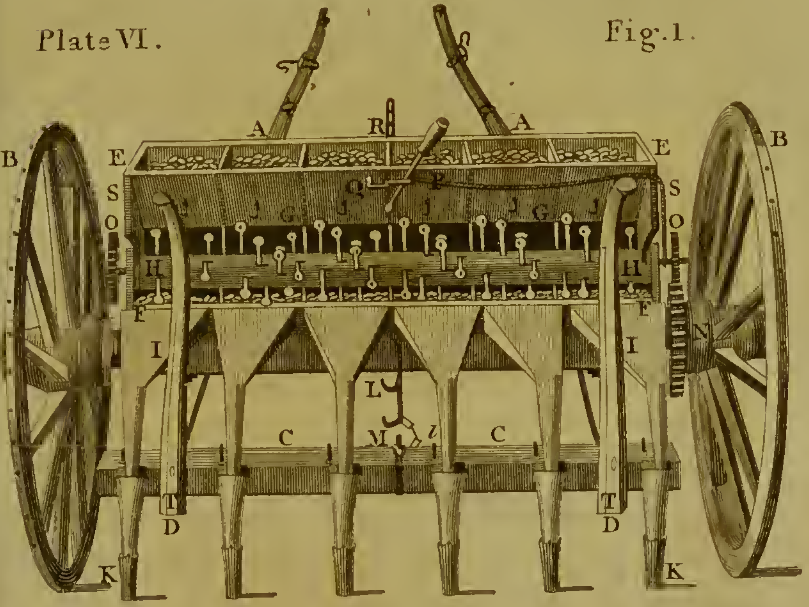
DD handles of the machine, applied to the coulter-beam at CC, by means of ſcrew-bolts, and nuts; alſo to the axis of the wheels, by hooks and eyes, or ſtaples.

The coulter-beam is readily moved to the right or left, by the perſon who attends the machine, ſo as to make the drills perfectly ſtraight, which is of

Mr. Cooke's *Patent Drill plough.*

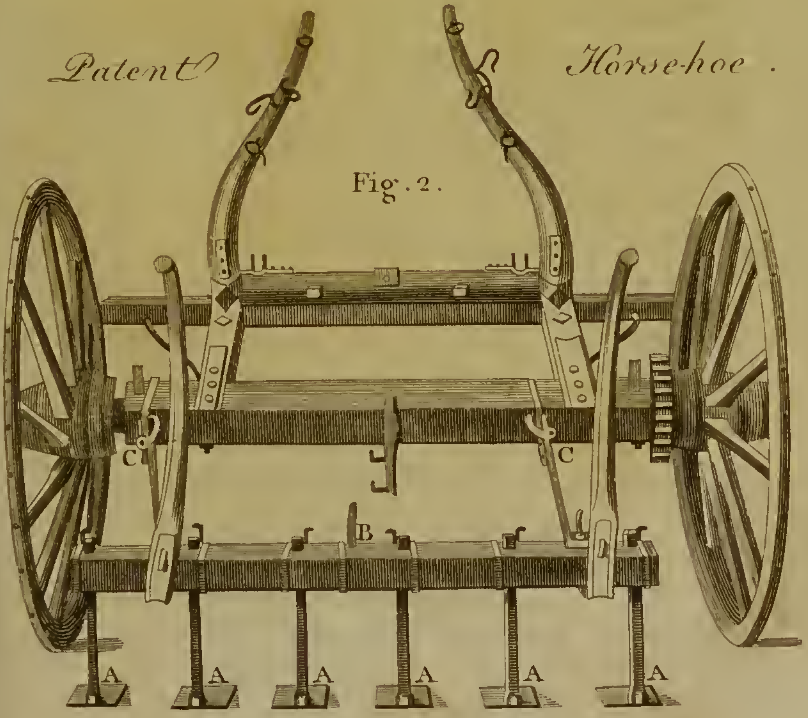
Plate VI.

Fig. 1.



Patent Horse-hoe.

Fig. 2.



T. Milne del. J. Lodge sc.

of great conſequence, as an accommodation to the horſe-hoe.

EE upper ſeed-box, in partitions, covered by a lid, to preſerve the ſeed from rain, or wind.

FF lower ſeed-box, in partitions.

GG ſlides between the upper and lower ſeed-boxes, to prevent the grain, or ſeed deſcending too faſt into the lower boxes: by elevating, or depreſſing theſe ſlides, the quantity of grain, or ſeed diſtributed in the drills, may be varied at pleaſure. When the ſlides are at the bottom of the grooves, the wheat-cups, or ladles, painted red, will diſtribute about three pecks per acre. When raiſed about two inches to the topmoſt holes, and ſupported there by hooks going into holes in the plates of the ſlides, ſomething more than five pecks will be ſown; and, by fixing the ſlides at any intermediate height, the quantity of ſeed ſown, may be varied accordingly. When barley is drilled, if the ſlides are at the bottom of the grooves, the cups, or ladles, painted green, will diſtribute about one buſhel and half per acre; and more in proportion as the ſlides are elevated. For ſowing beans, peas, oats, &c. if the ſlides are at the bottom of the grooves, the cups, or ladles, painted yellow, will diſtribute near two buſhels per acre; and more in proportion, by elevating them as above; up to three buſhels per acre.

HH cylinder, with cups, or ladles, of different ſizes, for different kinds of grain or ſeeds; by which the grain or ſeeds are taken up, and dropped into the funnel II, and conducted thereby into inciſions, or drills, made in the land by the coulters KK.

L a chain, and hook, applied to the coulter-beam CC, and axis of the wheels BB, to prevent the coulter's going too deep in the land; alſo to prevent the coulter-beam dropping ſo low, as to unſhift the upper funnels, in croſſing deep furrows, or gutters; on which account, when the machine is at work, the laſt link of the chain ſhould always be upon the hook.

M a pin of iron, projecting from the coulter-beam, which being lifted on to the hook, at the end of the land, will bear the coulters out of the ground, while the machine is turning round at the end of the land, or on any other occaſion, without any labour of the man, who attends the machine, in ſupporting the ſame.

N a cog-wheel upon the nave of the wheel B.

O a cog-wheel upon the gudgeon, or axis, of the cylinder H; which is turned by the wheel N, ſo as to diſtribute the grain, or ſeed, as above.

P a lever, and ſtring paſſing over a pulley to the axis of the cylinder H. By moving the lever P to a notch in the ſtaple Q, the wheel O will be lifted out of generation with the wheel N; by which means, the diſtribution of grain, or ſeed, may be ſtopped at pleaſure, in an inſtant, at the end of the land which the machine is turning round, or on any other occaſion.

R an iron bar, with holes in it, by means of which, and a pin going through the holes, the ſeed-box may be elevated, or depreſſed, ſo as to keep it horizontally level, whether going up or down ſteep hills.

SS ſtaples in the ends of the ſeed-box, for the reception of two ſlides of wood, with canvas applied to the ſame; alſo to ſmall ſtaples, at the end of the coulter-beam, to prevent the wind from interrupting the grain, or ſeed in its deſcent from the cups, or ladles, to the funnels, and will alſo prevent dirt, or ſoil falling from the wheels into the funnels II.

TT two hooks in the handles of the machine, to which weights, or a beam of wood of a proper weight, may be applied, to force the coulters, if neceſſary, deeper into the ground.

N. B. By the ſame means that the coulter-beam is ſupported at the end of the land, the machine is conveyed, upon its own wheels, from the farm-yard to the field, alſo from the field to the farm-yard, without the trouble of ſhipping, or unſhipping a ſingle article of the machine; and by putting the link of the chain on to the hook; without the leaſt danger of injuring the machine, upon the rougheſt road.

Lands, or ridges four feet ſix inches wide, on ſtrong clays, or cold wet ſoils, or ten feet wide on dry loams, are beſt adapted to the practical ſyſtem of drilling and horſe-hoeing. Where lands or ridges vary in ſize and width, or where there are no ridges, or furrows, one or more funnels may be ſtopped with a little paper, and the ſeed returned into the boxes, at the end of the land, in order to join the rows more regularly.

One horſe is adequate to the draught of this machine, in its improved ſtate, upon ſtrong land.

If poſſible, a fair ſeaſon, when the land is dry, ſhould be embraced for the proceſs of drilling. This may in general be inſured, by having land plowed up ready for ſowing, in good time, and by embracing the firſt favourable opportunity: whether it be a fortnight ſooner or later than the exact periodical time of ſeedneſs, is not very material, eſpecially as ſo much land will now be drilled in ſo little time, viz. ten acres a day, with one man, a boy, and one horſe; the land being previouſly harrowed, to level the ſurface: and where lands are made of a proper ſize for the horſe to go always in the furrow, as above, a driver is not at all neceſſary.

If, on high ridged lands, when the horſe goes in the furrow, the perſon who attends the machine does not chooſe to be at the trouble of influencing the direction of the coulters, by moving the coulter-beam to the right, or left, occaſionally; a rope, or chain, by being applied to the axis of the wheels, and alſo to the coulter-beam, will prevent the coulters from inclining towards the furrow, and will keep them in one uniform direction.

In drilling lands, or ridges, more than twice the width of the machine, or level lands without ridge and furrow, in order to join the two outſide drills regularly, the wheel of the machine muſt be brought very near to the laſt outſide drill. And if a ſpace of fourteen inches is allowed for the horſe to walk in, for the purpoſe of horſe-hoeing, the wheel muſt return in its own track.

Explanation of Mr. COOKE's *Patent Horſe-Hoe.*

fig. 2.

The prevents, the ſhafts, the axis, and wheels, the coulter-beam with handles, as in fig. 1. of the above drill-machine, are converted into a horſe-hoe, only by taking away a feed-box EE, the cylinder HH, the funnels II, and the coulters KK, as in fig. 1. and introducing the hoes AAAAAA in the places of the coulters.

B a guide

B a guide projecting from the hoe-beam, which the perſon who conducts the inſtrument, muſt keep directly over one of the rows of corn, when hoeing drills at nine inches apart, and over the middle of one of the ſpaces between the drills, when hoeing drills at twelve inches apart. And ſo long as he does this, it will be impoſſible to injure the crop, by cutting up any of the rows of corn. He will with the greateſt facility, keep the guide B over one of the rows of corn, or over the middle of one of the ſpaces between the rows of corn, by means of the hoe-beam, with ſix hoes of proper ſizes fixed in it, readily moving to the right, or left, upon the principles of a pentagraph, ſo as to counteract the horſe's draught, notwithſtanding he ſhould deviate from his proper line of traction, two feet, or more. Lands, or ridges, cannot be too level for practical horſe-hoeing. When they are too much ridged for all the hoes to be at work at one and the ſame time, ſo many of the hoes as cannot be brought into uſe, may be taken away. As this proceſs of horſe-hoeing is perfectly new, it is recommended to take the horſe-hoe with the coulters, inſtead of the hoes, over ſeveral acres of drilled crops, by which means the perſon who is appointed to do the buſineſs of horſe-hoeing, will become familiarized to the method of influencing the direction of the hoes, ſo as to avoid cutting up any of the rows of corn*.

The hoe-plates AAAAAA, fig. 2. are ſet to go deeper, or ſhallower, by elevating, or depreſſing the ends of the rails, which go from the coulter-beam to the hooks applied to the axis of the wheels CC; or by dropping, or raiſing the hoe-ſhanks in the mortices of the hoe-beam.

Mr. Malcomb†, a very experienced farmer, and gardener, greatly commends this machine, as much ſuperior to any thing of the kind he had ever ſeen, for depoſiting the grain at an equal depth, for delivering it evenly, and covering it properly. He ſays, it has an evident ſuperiority

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* When the ſurface of the land is too hard for the hoes to enter, one or more points or ſhares of iron, reſembling ſcarificators, or chiſſels, from half an inch to two inches broad, may be inſerted in the mortice in the ſhank of the hoe, for the purpoſe of breaking the texture of the ſoil in a dry ſeaſon; after which the hoe-plates will work pleaſantly, and effectually.

In proportion to the number and ſize of ſtones, or pebbles, in any ſtrong ſoil, the ſmaller muſt be the ſize of the hoe-plates intended to work in ſuch ſoils; and it may not be impoſſible to find a ſoil ſo intermixed with large ſtones, or pebbles, as to bid defiance to all flat-hoeing whatever; the ſcarificators, or ſhare-points, or chiſſels, as above-mentioned, will nevertheleſs be uſed with good effect. Upon all light lands, or loams, or other pulverized ſoils, the above horſe-hoe will effectually hoe ten acres a day.

† Lond. Soc. Tranſ. Vol. V. p. 78.

even

even on land that is fine; but muſt have a much greater, where the ſurface is rough, or uneven.

His trials of this drill-ſowing produced from one acre of land, and three buſhels of ſeed, ſeventy buſhels of wheat; from another acre, and two buſhels and a quarter of ſeed, ſeventy-four buſhels of wheat; which is undoubtedly a prodigious increaſe, and far ſuperior to the broad-caſt, which, from one acre ſowed with five buſhels of ſeed, produced ſixty-two buſhels of wheat; though even that is a remarkably large crop, and ſhews that the land muſt not only have been good, but in fine tilth.

Again, if we take this in another point of view, we ſhall perhaps be more ſenſible of the infinite ſuperiority of the drill-ſowing over the broad-caſt; for, in the former way, we here ſee two buſhels and a quarter producing ſeventy-four buſhels, which is an increaſe of nearly thirty-three for one, whereas in the latter we find the increaſe is very little more than twelve for one.

Mr. Boote, of Atherſton, near Stratford upon Avon, gives the ſame favourable account of the vaſt advantage of ſowing with this machine; and as a proof of his own decided good opinion, he ſays, he ſowed with it, in one year, three hundred and ſixty-eight acres. The reſult of this was, not only far better crops than in the broad-caſt way, but by hoeing theſe crops he ſaved the vaſt expence of ſummer fallows, which he means to lay aſide altogether in future. This is not all: for having taken an accurate account of the ſeed uſed in ſowing the above crops, he compared it with the quantity uſually ſown in broad-caſt, and found he had made another ſaving of at leaſt one hundred and fifty pounds in ſeed; which ſum, employed in hoeing, would prepare and clean his ground completely for a ſucceeding crop*.

So thoroughly convinced was this gentleman of the great advantage of drilling with Mr. Cooke's plough, that in the year following (1787), he ſowed with it no leſs than four hundred and fifty acres; viz. one hundred and twenty-ſix acres with wheat; one hundred and twenty-eight with barley; forty-five with beans; eighteen with peas; forty-five with oats; ſix with vetches; and eighty-two with turnips. Upon theſe he obſerves, that as the reſpective crops came into ear, a decided ſuperiority in favour of drilling was again ſelf-evident: every obſerver became an admirer, and the moſt ſtrenuous oppoſers became the moſt ſtrenuous advocates. Crops ſo luxuriant, ſo far ſurpaſſing all his neighbours, at the ſame time produced from land not of the firſt quality, could not fail to challenge the approbation of every beholder.

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* Lond. Soc. Tranſ. Vol. V. p. 80.

Mr. Boote thinks that he might challenge allt world to ſhew ſuch a quantity, or quality of drilled corn, upon any one farm, in one year. He ſeems alſo confident, that upon a fair calculation, he would gain by drilling, in the year 1787, at leaſt ſeven hundred pounds more than he would have done if he had ſown his land in the uſual way*. In the following Eſſay I ſhall have occaſion to give a more particular account of Mr. Boote's ſucceſs by this mode of ſowing.

Before I diſmiſs this ſubject, I think it neceſſary to mention another manner of depoſiting the ſeed in the ground, which has been lately practiſed in Norfolk, with great ſucceſs: which, indeed, will always be the caſe, where the ſoil is rich and light, and free of weeds; but on ſtrong, cold, or foul land, it will not anſwer, as I have found from repeated experience.

The manner I allude to, is, dibbling, with an inſtrument made for that purpoſe, and dropping the ſeed, that is, four, five, or ſix grains, into every hole made by this inſtrument. This idea is not new, although the practice has been carried to greater extent in Norfolk, than any thing of the kind that we know of in modern times. *Unguibus infodiunt et ipſis fruges*, ſays Virgil; and Platt's "Adam's Tool Revived," ſhews that attempts have formerly been made to bring it again into practice in this country.

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* Lond. Soc. Tranſ. Vol. VI. p. 74.

Accident ſeems firſt to have ſet it a-going in Norfolk. A little farmer near Norwich began it about fifteen years ago, upon leſs than an acre of land. For two or three years, few followed his example. They had, however, better corn and larger crops than their neighbours: this, with the ſaving in ſeed, tempted others to follow them. Some curious perſons obſerving its utility, publiſhed its ſucceſs, and recommended the practice in the Norwich papers. This excited many of the more conſiderable Norfolk farmers to make experiments; and one, more adventurous than the reſt, ſet fifty-ſeven acres in one year. The viſible ſuperiority of his crop, both in quantity and quality, was ſo palpable, that he the next autumn ſet three hundred acres, and has ever ſince continued the practice. This noble experiment was the means of introducing the mode among the intelligent farmers, in a very large diſtrict of land. The crops thus ſet appear very thin in autumn and winter; but the plants ſpread and tiller greatly in the ſpring: the ears are indiſputably larger, without any dwarfiſh, or ſmall corn, the grain is of more bulk, and ſpecifically heavier, than when ſown.

The lands on which this has been ſucceſsfully tried, are, a clover lay, or that on which trefoil, and graſs ſeed were ſown the laſt ſpring but one; and on which cattle had been paſtured during the ſummer. Theſe lands are once turned over by the plough, in an extended flag, or turf, at ten inches wide; along which a man who is called a dibbler, with two ſetting irons, bigger at the lower end, and pointed at the extremity, ſteps backwards along the turf, and makes the holes about four inches aſunder every way, and an inch deep. Into theſe holes the droppers, who are women, boys, and girls, drop two grains, which are quite ſufficient. After this, a gate, or hurdle, buſhed with thorns, is drawn by one horſe over the land, and cloſes the holes. Three pecks of grain are ſufficient for an acre. It is equally removed from vermin, or the power of froſt. Its regularity gives the beſt opportunity of keeping it clean, by weeding, or hand-hoeing.

To this account, extracted from the Bath Society's Tranſactions*, I muſt ſubjoin a few obſervations, the reſult of my own experience.

The ſaving of ſeed, taken both in a public, and a private point of view, is an object of great conſideration. The employing of women, boys, and girls, who might otherwiſe be idle, is alſo a matter of much importance. But were theſe quite out of the queſtion, I would not heſitate to give a decided preference to the drill-plough.

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* Vol. I. p. 1.

With all the attention I could give, and I gave a great deal, I never could get the land regularly dibbled, without the help of a line, which made it tedious; neither could I get the women, boys, or girls, to be in the leaſt regular in dropping the ſeed; ſo that upon examining the holes, I have often found in them from two to twenty grains.

In ſtiff cold land, the plants do not tiller ſufficiently to make a good crop; nor does a buſh-harrow fill the holes in ſuch a ſoil; and even when filled, I have ſeen the crows ſo well acquainted with their form and ſituation, that, by removing the looſe earth in each hole, they picked up every grain in them; ſo as to leave large intervals.

The expence too of this, though reduced to ſix ſhillings an acre in Norfolk, is conſiderably more than that of the drill, with which, from ſix to ten acres may be ſown in a day; and that with only one horſe, a man, and a boy. What can be more expeditious than this? Beſides, if my information be juſt, for I have not had the experience, one buſhel of wheat drilled is ſufficient for an acre. This, indeed, is two pecks more than need be uſed in ſetting: though I never could get my people to uſe leſs than four pecks, in that way. In this caſe, there appears to be no eſſential difference in the ſaving of ſeed; and I own, that if the depth is properly regulated by the drill, the diſpoſal of the ſeed by that machine ſeems to me rather better, and more equal, than by the uncertain dropping of a moſt untractable ſet of creatures, who will not allow themſelves to be guided, even to their own advantage.

After having made theſe obſervations in favour of the drill; I think it is but right to ſay, that I am far from wiſhing to check the further trials in ſetting; for, in the comparative methods of theſe two modes, ſeveral important points yet remain unaſcertained; viz. which produces moſt, from equal quantities of ſeed? which produces the beſt, and heavieſt grain? which grows the ſtrongeſt ſtraw, and leaſt liable to lodge? and, laſtly, by which of theſe ways the land is left in beſt order for the enſuing crop?

ARTICLE V.

Of the Change of Crops.

THE changing of crops, upon rational principles, though of infinite conſequence in agriculture,

ture, ſeems to have been neglected, and even forgotten after the time of the ancient Romans, till Camillo Tarello pointed out its great importance. Nor do we ſince him find much attention paid to this eſſential part of huſbandry, till very lately; when the culture of turnips, probably, gave the firſt uſeful hint. The farmer obſerving that his land, inſtead of being impoveriſhed by that root, was enriched, and prepared to yield a better crop of barley in the ſpring; this might naturally ſuggeſt to him, that other ſucculent plants, which cover the earth with their leaves, might have the ſame effect. The ſucceſs has anſwered his utmoſt expectation: for it is now found, that a fallow does not become neceſſary ſo often as formerly; the ground being kept in heart by a variety of crops, when rightly timed, and properly managed: and were the drill-huſbandry completely introduced, and well underſtood, I am perfectly convinced that all fallows would be entirely exploded, except upon very particular occaſions.

The Society of Improvers in the Knowledge of Agricultute, in Scotland, from whoſe tranſactions I ſhall borrow the following judicious inſtructions, have the honour of firſt ſetting this diſcovery in its proper light.

They obſerve, that ſome crops, ſuch as peas, beans, clover, tares, and all plants of the pulſe kind, are enrichers and cleaners of the ſoil; whilſt wheat, oats, barley, and the whole tribe of vegetables whoſe roots are fibrous, and ſpread far, impoveriſh and rob the ground. Theſe laſt are likewiſe foulers of it, by giving way to weeds and graſs, which, being the natural product of every ſoil, are more readily nouriſhed by it, than any plant which it does not ſpontaneouſly produce; and if the earth be fed with any ſort of manure, it will, while the weeds and graſs remain undeſtroyed, like a tender mother, cheriſh and nouriſh them in proportion to the food ſhe receives.

Wheat and oats, in particular, are great robbers of the ſoil. Wheat remains in the ground a long time, during which period the land untills itſelf, coaleſces, and becomes of the nature of uncultivated earth; while the weeds, meeting with no oppoſition, ripen and ſhed their ſeed. I am ſuppoſing it ſown broad-caſt: for by the new huſbandry, theſe inconveniencies are almoſt entirely removed. Oats do not continue ſo long as wheat; but they bind the ſoil by their ſtrong roots, and give many weeds time to ripen. Barley, as it ſtands only a few months, and has ſeveral plowings given for it, binds the earth leſs than wheat or oats. Peas, beans, tares, &c. are ſuppoſed to draw much of their nouriſhment from the atmoſphere, and that, in proportion to the ſucculency of their ſtems and leaves, whereby it is probable their roots diſcharge a moiſture under ground; and their leaves, covering the ſurface of the earth, return the moiſture and dews deſcending through them, which mellow and rot them into a kind of manure*.

The farmer may from hence be guided, how to vary his crop, ſo as to keep his ground in heart, and clear of weeds. Thus, in a ſtrong loam, let us ſuppoſe a crop of wheat ſucceeds a fallow, and that the ſtubble being plowed in, and the land laid up rough to the winter's froſts, is prepared for beans to be ſown in the ſpring. As it is eſſentially neceſſary to keep this ſoil conſtantly ſtirred; after the beans are taken off, it is again plowed up rough, to the influence of the winter's froſts, that it may be prepared for barley and clover in the ſpring. The ſecond crop of clover may be plowed in the next year, early enough to allow time for a ſecond plowing for wheat; which may be ſucceeded by a crop of beans, peas, tares, or any roots that the farmer may judge moſt proper. After theſe, a crop of oats may be taken, as preparatory to fallowing, which this kind of land requires more frequently than a light ſoil. If the earth is kept ſufficiently mellow, a crop of carrots, or parſneps, will bring a much more profitable return than turnips, on this ſoil; becauſe it is apt to be poached by the ſheep eating them off the ground, unleſs the weather prove very favourable for this purpoſe. A crop of winter vetches or tares may be taken previous to the ſowing of the barley. On the other hand, if the ſoil is light, turnips may be ſown as ſoon as the ground can be plowed after the wheat, which will prepare the earth for a crop of barley and clover, to be ſucceeded by wheat on one furrow, if the ground is in good heart. Peas, potatoes, or other pulſe, or roots, may properly ſucceed the wheat: and thus the ſkilful farmer will vary his courſe according to the demands at market, or his wants at home, attending only to the very eſſential circumſtance of taking alternate crops of pulſe and grain; by which means he will not only keep his land in better heart, but will ſave himſelf the frequent repetitions of a ſummer fallow, which are always done at great expence.

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* Dr. Fordyce obſerves, that all plants abſorb nouriſhment by their leaves, as well as by their roots; and that whilſt their leaves are flouriſhing, they diſcharge into the ground a part of their juices; and till they begin to flower, they diſcharge a greater quantity than what they receive from the earth: conſequently, till then, they enrich the ground. Succulent plants, having moſt leaves, diſcharge moſt moiſture by their roots.

Even in the new huſbandry, a due regard to alternate cropping is a matter of much importance:

ance: for, by means of the judicious management of theſe, ſummer fallows may be altogether avoided: an improvement of no ſmall conſequence to the public, as well as to the farmer.

ARTICLE VI.

Of the Change of Seed.

ALL writers on Agriculture have conſtantly recommended, to change the ſeeds of every kind of grain, for ſowing; for which they have endeavoured to aſſign plauſible reaſons, which, I confeſs, have never appeared to me ſenſible or ſatisfactory.

In huſbandry, and indeed in all other affairs, I am ſo much attached to experience, in preference to reaſoning, that I deſire to ſubſcribe to whatever comes recommended from that ſchool. But in this caſe, is there not ſome doubt whether the opinion originates in that ſchool, or whether it is not one of thoſe vague traditional ideas handed from farmer to farmer, from father to ſon, and from author to author? Some farmers, as well as writers, are of opinion, that plants not only degenerate, if the ſeed is not changed, but that they even change their ſpecies, ſo that wheat becomes barley, and oats tares, &c. When an idea ſo abſurd as this laſt has been propagated, ſhould we be ſurpriſed that the former, which is at leaſt more probable, ſhould have met with a ſucceſſion of abettors?

I do not mean, by what I have ſaid, to refute this ſyſtem: I wiſh only to have it rationally explained, or proved by experience. I am very ſenſible, that plants are ſubject to what Dr. Fordyce calls habits, which may make the change of ſeed of ſome importance. Seeds, ſays that ingenious writer, by having been propagated in dry, ſandy, warm ſoils, may acquire the habit of growing too early in the ſpring, and their ſtems puſhing up too ſoon into flower, and producing but few ſeeds when propagated in a moiſt, ſtiff, cold ſoil, will naturally acquire the habit of growing too late, of being long of puſhing up the ſtem, ſo that there is often no time for the ſeed to ripen. If propagated in a very rich ſoil, they acquire the habit of growing exceedingly ſtrong in all their parts, in which caſe, too few flowers are often produced; and laſtly, when propagated in poor ſoils, they get the habit of growing weak, and producing ſmall ſeeds. Theſe affect the graſſes particularly.

So far, therefore, as habits go, we ſee that the change of ſeed may be attended with good effects; by bringing thoſe which have been raiſed on a light, dry ſoil, to a ſtrong, wet one, and vice verſa. But this is not all; for we are told by a Norfolk farmer of great experience, that the neceſſity of a change of ſeed, by not ſowing two years together what grew on the ſame ſoil, is not in any part of huſbandry more evident, than in the culture of barley, which, if not frequently changed, will grow *coarſer and coarſer* every year[*].

Another perſon, of great knowledge, informs us, that he is of opinion, that crops of graſſes, as well as grain, might be much improved, and the quantity conſiderably increaſed, by a change of ſoil and ſituation; or, in other words, by changing the ſeed. He ſowed a ſmall field with marle graſs ſeed, from Kent, and the crop was much ſuperior to that of another field ſown with the ſame kind of graſs ſeed, which had been raiſed in his neighbourhood; although the ſoil, and quantity of ſeed ſown per acre, were the ſame. There are, ſays he, myſteries in the nature and progreſs of vegetation, which no theory can account for. While the effects are evident, the cauſe remains unexplicable. Experience, therefore, is our beſt director; and that ſeems uniformly to prove the utility of a change of ſeed in almoſt every production of our fields and gardens.

If this be really the fact, it puts an end to any farther doubts upon this ſubject. At all events, the practice is ſanctioned by cuſtom; and it is moſt probable, the cuſtom took its riſe from experience. Neither is there any thing, that I am acquainted with, that amounts to the refutation of a ſyſtem ſo generally admitted: and for theſe reaſons it would be very imprudent not to acquieſce implicitly, at leaſt till we are otherwiſe inſtructed.

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[*] Bath Soc. Tranſ. Vol. II. p. 97.

If the farmer has not ſeed of his own, free from every viſible imperfection, it would be highly improper in him, not to change his ſeed, by procuring the beſt in his power: for though it be found, that poor ſeed will ſometimes produce good and thriving plants; yet the huſbandman ſhould never run a riſk, when his intereſt is ſo much at ſtake.

ESSAY IV.

Of the Culture of Grain, and Pulſe.

SECTION I.

Of Wheat, and Rye.

IT has been very juſtly obſerved by the ancients, as well as the moderns, that wheat will grow in almoſt any part of the world: and as it is the plant moſt neceſſary to mankind, rice only excepted; ſo, next to rice, it is the moſt general, and the moſt fruitful. It thrives not only in temperate climates, but alſo in very hot and very cold regions; and even when ſown in places where it never grew ſpontaneouſly, ſucceeds as well as where it has always been common.

The ſucceſs of wheat in America plainly proves this: and in Peru and Chili in particular, where this grain was not known till the Europeans introduced it there, it now produces as large crops as in moſt parts of Europe.

Wheat ſhould be ſown in autumn, and always when the ground is moiſt. In the downs of Hampſhire, Wiltſhire, and Dorſetſhire, farmers begin to ſow their wheat in Auguſt, if any rain has fallen; and even employ their people to ſow in one place, while they reap in another: for if the corn is not forward in autumn, ſo as to cover the ground before winter, it ſeldom does well on thoſe high dry lands, eſpecially if the enſuing ſpring prove likewiſe dry. In low ſtrong lands, ſome huſbandmen think they are in good ſeaſon if they get their wheat into the ground by the middle of November; nay, it is ſometimes Chriſtmas, or even later, before all their wheat is ſown. But this late ſown wheat, beſides being apt to run too much to ſtraw, eſpecially if the ſpring be moiſt, is liable to be thrown out of the ground by froſts, as has been already obſerved.

In general, all wheat ſucceeds beſt upon ſtrong ſoils, particularly if they have been well drained, ſo that the corn lies dry; but as ſome ſorts of this grain thrive better in ſome ſoils than in others, it might redound to the public welfare, if more accurate obſervations were judiciouſly made in regard to each kind. The white egg-ſhell wheat is reckoned beſt for light land, and to ſow with rye for meſlin; becauſe it ripens ſooneſt. It is indeed of little uſe in this country for this purpoſe, as a mixture of wheat and rye flour is not marketable here. This wheat ſhould be the earlieſt in the ground: it is much ſown in Eſſex upon their hazely loams, or brick earths; as the red wheat, and the Poland bearded wheat are alſo, both there and in this county, upon ſtiff yellow clays. The white Poland, or Pole-rivet, has not a hollow ſtraw, and is therefore not ſo ſubject to lodge, as other corn that has. This kind is particularly fit for lands where the crop is apt to run much to ſtraw.

In Oxfordſhire, they have a ſort of wheat, which they call long-coned wheat, and reckon the beſt for rank clays. Its ſtraw not being hollow, it is the leſs liable to lodge; and farmers obſerve it is the leaſt apt to be mildewed, or to be eaten by birds, from which laſt it is greatly guarded by its long rough awns; but the flour of it is ſomewhat coarſe. Their white kind of red-grained wheat is a very good ſort for clayey land: it yields a good crop, and ſeldom ſmuts.

In Staffordſhire, they reckon the red Lammas, or bearded wheat, the beſt for cold lands, or ſtiff clays.

In Berkſhire, they have a ſort called pendulum-wheat, lum-wheat, from the hanging of its ears, much like the cone-wheat.

In Northamptonſhire, they have a ſort of wheat with a white ſtraw, and reddiſh ear and grain; much commended for the plumpneſs and largeneſs of the grain, and ſtrength of the ſtraw, which prevents its being ſubject to lodge; nor is it apt to be eaten by birds. They have alſo a red-eared bearded wheat, and a ſort of pollard, or duck-bill wheat, as it is called, known in Suſſex by the name of fuller's wheat, which has ſo cloſe and thick a huſk, that the birds never injure it. Mr. Miller obſerves, that this ſort of wheat grows very tall, and if it be ſown too thick, is very apt to be lodged by rain and wind; for that its ears are large and heavy, and inclined on one ſide, as the grain increaſes in weight; but that, if its roots are at a proper diſtance from each other, it will tiller greatly, and have ſtrong ſtalks, and that the grain of this wheat yields more flour in proportion, than that of any other ſort. The awns of this wheat always drop off when the grain is full grown.

Smyrna-wheat, commonly called many-eared wheat, becauſe ſeveral leſſer, or collateral ears, grow around the bottom of the main ear, which is very large in its ſtate of perfection, requires more nouriſhment than the common huſbandry can give it, and therefore is not cultivated by our farmers: but it would probably do extremely well with the horſe-hoeing huſbandry, where the quantity of pabulum can be enlarged almoſt at pleaſure. For the ſame reaſon, maize, commonly called Turkey, or Indian corn, is fitteſt for this laſt huſbandry, as will be more particularly noticed hereafter.

Some gentlemen have been curious enough to procure their ſeed-wheat from Sicily, and it has ſucceeded very well as to growth; but the grain of this ſpecies has proved too hard for our Engliſh mills to grind.

Mr. Boys, of Betſhanger, near Sandwich, in Kent, has given us the following particulars reſpecting ſome comparative trials of different kinds of wheat, made by him, viz.

	Qrs.	Bs.	Gs.
Hoary white, produce per acre	3	4	3
Fulham ....ditto................	3	4	2
White ſtraw........ditto................	3	4	0
Yellow Lammas....ditto................	3	0	0
Brown ditto........ditto................	2	7	4

In another year's trial, ſtill the hoary white kept the ſuperiority, both in point of quantity and price; having fetched one ſhilling and one ſhilling and ſixpence per quarter more, at market, than any of the other kinds. Mr. Boys ſays, theſe trials were all made on the ſame field, the ſoil exactly the ſame, all ſowed in one day, managed preciſely in the ſame manner, laid ſeparately in the barn, and carefully threſhed and meaſured.

It is to be obſerved, that the ſoil in that part of the country is very light, ſo that the hoary white, which ſucceeded ſo well here, might not be ſo ſucceſsful on a ſtrong ſoil. The Fulham, which in this trial approaches neareſt to the hoary-white, Mr. Boys ſays, is a coarſe wheat, with thick bran, and of inferior value. He adds, that the egg-ſhell-white is a good deal in uſe in that part of the country; but that he does not approve of it, from the facility it has of dropping its grain in the field; which would not ſuit his bleak, and expoſed ſituation; otherwiſe, it is a ſpecies much eſteemed by the millers*. Perhaps this defect might be overcome, by reaping it ſomewhat ſooner than common.

I have already mentioned my ideas, with regard to the proper time of ſowing wheat, and ſhall only further obſerve, that any farmer in this country, who has not finiſhed that buſineſs by the end of October, at lateſt, will have much cauſe to repent of his delay.

I have alſo given my opinion of the quantity of ſeed which ought to be ſown; a matter of real conſequence, not only to the farmer, but alſo to the public at large. Becauſe, unneceſſary quantities of grain laviſhed away in that manner, impoveriſh the country, as well as the individual. And ſo far is it from obtaining the end deſired, that it acts in a quite contrary way: for even allowing, that a profuſe ſowing of ſeed produces a greater crop, that crop will be feeble, with poor ſtraw, ſmall ears, and light grain. The ſtraw being weak, will be eaſily lodged, and difficult to reap, and thus the produce will be altogether deficient.

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* Lond. Soc. Tranſ. Vol. III. p. 19, &c.

More ſeed is commonly ſown on newly broken up lands, than upon thoſe which have been longer in tillage. Perhaps this may be neceſſary, from the ſluggiſh inactivity of the ſoil, never before expoſed to the fertilizing influence of the ſun, and of the air, or from a greater number of inſects, which may have multiplied there undiſturbed: but if ſuch lands are manured with quick-lime, as before directed, both theſe defects will be removed, and then they will require no more than the uſual quantity of ſeed.

Wheat may be placed in the ground from half an inch to three inches deep; the lighter the ſoil, the deeper the ſeed ſhould be covered;

for the air, and the moiſture of rains and dews, will more eaſily reach it in ſuch lands.

Great care ſhould be taken to guard againſt rooks, juſt at the time the wheat is ſhooting: for theſe miſchievous animals perceive its ſprouting ſooner than the farmer, and are led by the ſhoot, to pick it up. They ſhould therefore be carefully watched for a week or ten days; for at the end of that time, the blade will be grown, and the grain exhauſted of its ſubſtance, ſo as to be no longer the cauſe of temptation. They ſeldom moleſt much the wheat ſown in September, becauſe they are then more fully, and more eaſily ſupplied by the grain of the late harveſt, ſcattered over the fields.

No part of huſbandry requires the farmer's attention more, than keeping his land free from weeds: yet many give themſelves no trouble about this moſt eſſential article, are not ſenſible of its importance, nor underſtand the proper method of doing it: nay, many do not even know which weeds are annual, and which perennial; a diſtinction highly neceſſary to be made by every perſon who would keep his ground clean, and in good order; and without which, the greateſt induſtry will often be baffled.

Annual weeds may be ſoon deſtroyed, if taken in time; but if they are neglected, their ſeeds will ripen, and ſow themſelves in ſuch abundance, that much additional labour and expence will be required to do that, which might have been performed with eaſe at the beginning, without ſubjecting the corn to be robbed by its bad neighbours. The common method of weeding is very abſurd: for in that practice, the weeds grow till the wheat begins to ear, and they are in flower; by which means, the ground being covered by the corn, all the low weeds are hid, left to ripen, and ſcatter their ſeed: the tall weeds only are taken out; and, if the people employed are not careful, many of theſe will eſcape them, by being ſo intermixed with the ſtalks of the wheat, as not inſtantly to be diſtinguiſhed. At the ſame time, great numbers of the plants of wheat are broken and trod under foot by the weeders.

To obviate theſe inconveniencies, Mr. Miller recommends the method now practiſed by good kitchen gardeners; who clear their ground with a ſmall kind of hoe, which, if uſed amongſt the wheat early in the ſpring, before the ground is covered with the blades of corn, will effectually eradicate all the weeds; eſpecially if this work be done in dry weather. If the ground happens to be very full of weeds, it may be neceſſary to go over it a ſecond time, about a fortnight after the firſt, to cut up thoſe which were too ſmall to be noticed before. By ſuch means the corn will be kept clean, and there will not be time for new weeds to grow up to do it any great harm: for the ground will be ſo much ſhaded by the corn, that the weeds will be kept down, ſo as not to ripen their ſeeds before harveſt.

If, during this operation, ſome of the plants of corn are cut up, where they grow too cloſe, the reſt will be greatly benefited thereby. Mr. Miller ſeems doubtful, that few of the old farmers would ſubſcribe to this doctrine; though he advances it not from theory, but from experiments, repeated with great care, and ſuch ſucceſs, that the produce of twenty rods of ground was much greater, both in weight, and meaſure, than that of the ſame extent in the very beſt part of the field, where this was not practiſed; and the ſtalks of the corn thus thinned ſtood upright, when a great part of the crop in the ſame field was lodged.

When a crop of broad-caſt wheat is too thick, and in a feeble and declining ſtate in the ſpring, it is a good way to harrow it. This has been often practiſed with great ſucceſs; for it not only thins the crop, but, by giving a freſh ſtirring to the ſoil, looſens it, earths up the remaining plants, gives acceſs to moiſture, and makes room for the fibrous roots to puſh anew, and reſtore vigour to the plants. This is one of the ſtrongeſt proofs of the utility of the new huſbandry.

Both the advantage of having the plants of corn at proper diſtances from each other, and that of keeping them quite free from weeds, two important objects, almoſt impoſſible to be effected completely in the broad-caſt method of ſowing, are fully obtained by the new huſbandry; as will be evidently ſhewn.

M. du Hamel, and Mr. Miller, juſtly blame the practice of thoſe who either turn hogs in among their wheat, to deſtroy part of it when it grows too thick; or ſheep to eat it down, when they think it too rank. The abſurdity of the former is ſelf-evident: and in regard to the latter, it is well known, that the leaves, or blades of corn are neceſſary, to draw in nouriſhment from the air and dews, for the increaſe of the ſtalk and ear. To be thoroughly ſatisfied of this, Mr. Miller cut off the leaves of ſome plants of wheat, alternately, early in the ſpring, and always found the ſtalks of theſe plants much ſmaller, the ears ſhorter, and the grain poorer, than thoſe of the intermediate plants, whoſe blades were not cut. Several experiments made by M. du Hamel have proved, not only that all plants are impeded in their growth, and rendered leſs perfect in their productions, but that they are even frequently killed, by ſtripping them of their leaves: and this is confirmed by Mr. Miller, who adds, that he has frequently obſerved in gardens, that plants diveſted only of their lower leaves, plucked off by ignorant perſons, upon a ſuppoſition of their drawing the nouriſhment from the head, have been greatly weakened thereby. The ſame will undoubtedly hold good with reſpect to corn: beſides which, cattle, and particularly ſheep, will often bite ſo cloſe, as to deſtroy the crown of the plant, from whence its future growth ſhould proceed. If, therefore, it is ever expedient to eat down the luxuriant growth of wheat by ſheep, great care ſhould be taken, that they be not allowed to paſture on it too long. When they have eaten off the tops, they ought then to be removed, leſt they do miſchief by nibbling it too cloſe: to prevent which, be careful to turn them in when hungry, and remove them before they are ſatiated; for thus, they will not bite ſo cloſe.

Wheat is ripe when its ſtraw is turned yellow, its ears hang, no greenneſs appears in the middle of them, and the grain is hard when bitten. From four to five quarters is reckoned a good crop: but it is hardly to be credited, how much beyond this the produce of good ground, thoroughly well cultivated, may be increaſed. Thoſe who are ſenſible of the vaſt advantages of a perfect culture, will not be ſurpriſed at Mr. Miller's aſſuring us, that he has known eight or ten quarters, and even more, per acre, reaped over a field, where the corn has ſtood thin upon the ground; and that he has been informed by perſons of great credit, that even twelve quarters have been reaped from an acre of land drilled and managed with the horſe hoe.

Mr. Miller is of opinion, that all the Rye cultivated in England is but one ſpecies, though diſtinguiſhed by farmers into winter and ſpring rye; between which he has not been able to find any real difference, after cultivating them ſeveral years on the ſame land.

The winter-rye, which has the largeſt grain, is what the generality of farmers cultivate. It is uſually ſown in autumn, at the ſame time as wheat; and in many of our northern counties, as well as in Wales, they uſed formerly to ſow them together, though this was certainly extremely bad huſbandry, becauſe the rye will always ripen ſooner than the wheat; ſo that if the latter be let ſtand till fit for reaping, the former will run the riſk of ſhattering; nor ſhould this be practiſed, where the people are not accuſtomed to eat rye-bread, as I before obſerved: for though ſome account it good when mixed, yet few who have been uſed to bread made of wheat alone, will ever rightly reliſh it.

Beſides, rye does not require the ſame ſoil as wheat; ſo that it is employing land improperly to mix them. For rye is generally ſown on poor, dry, gravelly, or ſandy land, where it does well, but where wheat would not thrive. The ground ſhould be dry when it is ſown: for if much rain falls, even after ſowing, before the rye is come up, there is great danger of its rotting in the earth. It riſes in a much ſhorter time than wheat; and when ſown on light land, it ripens much earlier than on cold ſtiff grounds. By continuing to ſow it on a dry light ſoil, for two or three years running, it will be forwarded ſo much, as to ripen a month earlier than that which has been long raiſed on ſtrong cold ground: and this affords one inſtance, among many, of the effect of habit in plants; of which notice has already been taken. Thoſe who are obliged to ſow rye towards ſpring, ſhould always endeavour to provide themſelves with this early ſeed. A little ſprinkling of dung, or mud, though but half the quantity commonly uſed for other corn-land, will, if laid upon the rye-ground, greatly advance the crop. The uſual allowance is, two buſhels of ſeed to a ſtatute acre; or, if it be newly-broken-up ground, or land ſubject to worms, about a peck more, except where it has been manured with quick-lime, in which caſe any additional quantity of ſeed is perfectly unneceſſary. The produce is averagely about twenty buſhels per acre. In the ſummer of the year 1699, which was uncommonly dry, Mr. Mortimer reckoned ninety grains a-piece in ſeveral ears of rye.

The ſmall rye may be ſown in the ſpring, about the ſame time as oats, and uſually ripens as ſoon as the other ſort: but if the ſeaſon proves wet, it is apt to run much to ſtraw, and the grain is generally lighter than that of the other. The principal uſe of this ſort is to re-ſow thoſe lands where the autumnal crop has failed.

This corn is ripe when its ſtraw turns yellow, its ear hangs, and its grain is hard. It is not very apt to ſhed, and therefore, if it be weedy, (though this ought never to be the caſe with any corn), it ſhould be let lie upon the ground, or gavel, as ſome call it, a week or ten days after it is cut, till the weeds are withered or dried, when it may be bound up; for otherwiſe thoſe weeds will give in the barn, make the rye threſh ill, and render it muſty.

But as this grain will grow in the ear ſooner than any other, if it be wet, particular care muſt be taken, eſpecially if rain comes on, to turn it every two or three days, and lay the ears upon the ſtubble, as high above the ground as poſſible. This will help to preſerve it from hurtful moiſture: but if it be cut in dry weather, and without weeds, it may be immediately houſed.

The general uſe of rye was, formerly, for bread, either alone, or mixed with wheat, in which ſtate it is called meſlin-corn. It alſo yields a ſtrong ſpirit, when diſtilled; and is now, I am informed, principally conſumed in this way. If ſowed only for dreſſing of land, it is of great ſervice to the ground, when it is plowed in green and ſucculent. Dr. Elliot, of America, informs us*, from his own obſervation, that if rye be ſown ſucceſſively year after year, upon the ſame land, both the crop and land will be greatly improved; inſomuch that ground, which at firſt would not yield above five buſhels per acre, would, in time, afford a crop of fifteen to the acre, without manure of any kind. This fact is ſo uncommon, that I am apt to imagine the improvement might perhaps be owing to ſome other cauſe. Might not this land have been newly broken up, and rendered more fertile by repeated plowings, pulverization, and expoſure to the air?

I have already mentioned, from the Marquis of Turbilly's authority, the peculiar utility of the rye-ſtraw, in feeding of oxen during the winter.

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* Eſſays on Field-Huſbandry, p. 60, laſt edition.

This plant is likewiſe ſown in autumn to great advantage, purpoſely for green feed for cattle, particularly ewes and lambs in the ſpring, before there is plenty of graſs: when this is intended, the rye ſhould be ſown early, that it may have ſtrength to furniſh early fodder. In this light, it ſupplies in ſome ſort the want of turnips, where they have failed, or where their ſeaſon is over: ſo that, in ſuch caſes, it is very good huſbandry to ſow the land with rye; eſpecially where there are flocks of ſheep, which cannot be well ſupported without green food early in the ſpring. The farmer who has many ſheep, ſhould conſider, that turnips are always a very precarious crop; and therefore he ſhould, beſides ſowing ſome places with cole-ſeed, in order to have green fodder, ſow rye in others, to guard againſt accidents; unleſs the proper culture of the turnip-rooted cabbage may be ſuppoſed to have put him out of all danger of want. Of this we ſhall have occaſion to treat very fully hereafter.

Where early-ſowed turnips have failed, the ſame land may be ſown in autumn with rye, or with rye and winter tares, which will turn to good account; for they will give a large quantity of green food for cattle, early in the ſpring, when it is moſt wanted. To have ſuch food early for cattle, ſome ſplit the ridges of their wheat ſtubble, and ſow them with rye, allowing about a buſhel of ſeed to an acre, which they harrow in, and feed about April, or when they want it, and in May they plow it up for a fallow. It is wrong ever to turn cattle of any kind into a field of rye intended for grain, becauſe they not only do the ſame injury to it which they do to wheat, but alſo make holes with their feet, which, retaining the water, do great harm to the rye, which cannot bear wet. Even in Leiceſterſhire, where they improperly winter-feed their wheat, they never feed their rye, becauſe it is too tender to bear it.

Both wheat and rye may be cut ſomewhat before they are thoroughly ripe, eſpecially if they be lodged; for if the ſtraw be broken, it will no longer convey any nouriſhment to the grain. M. du Hamel ſeems to think this even the moſt eligible way for wheat, becauſe the grain will harden afterwards in the ſheaf; whereas, if it be let ſtand till it is too ripe, it will ſhed greatly in cutting, binding, and carrying home. It is partly to prevent this inconvenience, that good huſbandmen tie it in the evening, and carry it off next morning. The ancients reaped their corn before it was fully ripe, as Pliny informs us. And indeed it muſt be allowed, that very great diſadvantages attend the letting ſome ſorts of corn ſtand till their grains have acquired their utmoſt maturity. Both the chaff and the fodder are the worſe for it; and if ſuch ripe corn takes wet, the quality of the flour from wheat is greatly impaired, and the quantity diminiſhed; the increaſe of the malt from barley is alſo loſt, it having already ſpent itſelf. But if corn be cut greeniſh, it will bear a pretty deal of wet, without damage, for it will not imbibe the water like full ripe corn, but only take in ſo much as to be kindly fed thereby. I believe there is no county in England where they cut wheat ſo green as in this. It is nevertheleſs pretty plump in the grain, with a very bright colour, and grinds into fine flour; for Hertfordſhire whites are every where famous.

If any ſort of corn be blighted, the ſooner it is cut down, though but half ripe, the better it will be; for nouriſhment can no longer be conveyed to it by the ſtraw, but it will be fed by lying in the ear. The ſtraw becomes more and more brittle by ſtanding till the corn is ripe; and the grain comes the cleaner from the huſk when threſhed, if this blighted ſort be cut early.

One man, with a binder, may reap an acre of wheat, and ſomewhat more of rye, in a day, if the corn ſtand well: he will alſo clear about an acre of peas, vetches, &c. in the ſame ſpace of time.

The medium price of wheat in this country is about five ſhillings and ſixpence per buſhel. If it be under four ſhillings and ſixpence, the farmer can hardly pay his rent, and live; if it exceeds ſix ſhillings and ſixpence, the poorer ſort of people can ill afford to purchaſe wheaten bread. A buſhel of wheat weighs from fifty-ſix to ſixty-ſix pounds; a buſhel of barley, from forty-four to forty-ſeven pounds; and a buſhel of peas, from ſixty-three to ſixty-ſix pounds.

The huſbandman, ſays M. du Hamel, cannot have a more favourable ſeaſon to get in his corn, than that which is afforded him by hot and dry weather: for the quality of the grain is improved, and it is rendered much fitter for keeping, by the ſun's having acted powerfully upon it, either towards the latter part of its growing, or juſt after it has been cut: though it is true, on the other hand, that this very circumſtance makes the ears more ready to ſhed their grain, and that much of the value of a ſowing is often loſt thereby. To prevent this as much as poſſible, the corn is firſt laid in grips, and then tied up in ſheaves, in the cool of the evening, or early in the morning, before the heat comes on.

The two uſual ways of cutting corn are, either with the ſcythe, or with the ſickle. The former is commonly uſed for oats and barley, or ſometimes

times for very thin, ſhort wheat; and the ſickle is generally appropriated to the reaping of tall and thick wheat, and rye. The ſcythe diſpatches ſo much more work than the ſickle, that the difference of expence between reaping or mowing an acre, is nearly in the proportion of five to two.

In this part of the country, we ſtill reap our wheat and rye; though I do not ſee any very good reaſon why that work may not be done to as much advantage with a cradle ſcythe, as it is called; ſuch a ſcythe, well managed, lays the ſwarths very regular, and has even ſome advantages over the ſickle, beſides thoſe of cheapneſs and diſpatch. The ſtraw, by this method, is cut longer and more equal than when reaped, which is a conſiderable ſaving: I think too, that the corn is leſs ſhaken in this way, than by reaping, which prevents much ſhedding of grain; and alſo that fewer ears are ſcattered for the uſe of the gleaner. It is true, much of this œconomy depends upon the care and addreſs of the binder, who follows, to lay the grips in a proper poſition. This conſiſts in laying them in a triangular form, ſo that the head of one reſts upon the foot of another. This operation is neither long, nor fatiguing; and in order to do it quick, requires only a a little practice and dexterity in cloſing the triangle, by making the foot of the third grip ſupport the ears of the firſt. In doing this, the binder muſt be very attentive to collect his grips neatly, loſing no ears that can be ſaved, and placing them as regularly as poſſible. By ſuch means, the binding of the whole into ſheaves will be an eaſy proceſs: but as this is altogether new in this part of the country, it muſt be carefully watched by the farmer who attempts it.

For my own part, I can ſee no inconveniency attending this method, except that the ears may not be quite ſo regularly placed in the ſheaves, as they are when the corn is reaped. It may be ſo: but does any very bad conſequence follow? Surely the threſher, if he underſtands his trade, threſhes over the whole ſheaf, and not on one part alone.

Wheat which is full of weeds when cut, ought to lie ſome time before it is bound up, to allow thoſe weeds time to wilt or wither; otherwiſe they communicate their moiſture to the corn and ſtraw, and create muſtineſs, and other bad taſtes. A ſingle ſhower, or even a day's gentle rain, while it lies in ſwarth, is thought to be rather beneficial to the grain, by making it feel ſmooth and ſlippery, and threſh better: but all poſſible care ſhould be taken againſt its being wetted too much. For when, by unavoidable accident, it is laid up not thoroughly dry, it not only grows muſty in the mow, but will ſweat and cling together after it is threſhed and laid in a heap, and will grow as white with mouldineſs, as if it had been ſtrewed with flour. Such corn will not keep; and ſhould therefore be ſent to market, and ſold, as ſoon as threſhed.

In Scotland, in Oxfordſhire, and in ſeveral other places, they bind up their wheat in ſheaves, immediately when reaped, though it be full of weeds, and ſet three ſheaves ſomewhat ſloping againſt three others, to ſupport them; after which they cover their tops with two ſheaves, opened at their ear-ends, which are extended, and placed downward. In this ſituation they let their wheat ſtand three weeks, or a month in the field, before they carry it in; for no wet can hurt it, nor is it apt to grow in the ear, when thus ſheltered: but ſure it is a great error to bind up their ſheaves with unwithered weeds, though the reſt of their management is excellent.

Though moſt corn is better for lying a while in ſwarth, or in grips, to take the dews, which contribute to render its grain plump, and of a good colour; yet its ſtraw becomes thereby the worſe for fodder, unleſs it was cut before it had attained full maturity, and lay out no longer than till it be ſufficiently ripened. In hot dry ſummers, when the corn ripens fully, and its own vigour gives a proper colour, and plumps up the grain, ſo that the huſks readily yield their contents when threſhed;

ed; wheat need not lie out in ſwarth, or grip, before it is ſheaved, or after it is put in ſheaf, unleſs it be very full of graſs, or weeds: but in cold ſummers, the wheat is horny and pale, the grains are thin, and require being plumped; and their huſks cling ſo cloſe, that they muſt be mellowed, in order to make them threſh well.

In proportion to the heat of the weather, greater expedition is neceſſary in reaping; for corn, when haſtily ripened, ſcorched by the ſun, and full in grain, ſoon takes a ſtain, is damaged by wet, and eaſily ſheds at every blaſt of wind. The prudent huſbandman ſhould therefore, in ſuch caſes, employ the greater number of reapers, or mowers; for he cannot deſire more, than that his corn be perfectly ripe, and of good colour: for which reaſon, the leſs it then lies abroad in grip, or ſheaf, the better it will be. Cutting it high up, ſo as to avoid the intermixed graſs and weeds as much as poſſible, by which means it is the ſooner fit for carting, has been found very ſerviceable on ſuch occaſions.

It is always moſt adviſeable to turn the grips of wheat which are left out, very early after their being cut down, in order to get them dry as ſoon as poſſible. By this method, they are kept the longer from ſprouting in the ear, in caſe of rain; for if dripping weather, or driving miſt ſhould enſue,

ſue, and continue for any time after they have been loaded with wet, all the art of man cannot prevent them from growing: nay, even independent of other accidents, the bare weight of the ears will ſink the grip of wheat to the ground, though they have been laid ever ſo light and hollow; and they will certainly be injured thereby, if they lie long out in wet weather. The beſt way of preventing this, is by laying them in triangles, as before mentioned. It is, perhaps, partly for this reaſon, that the farmers in Leiceſter and Northamptonſhire, where the land is rich, deep, lies flat, and is much incloſed, leave a high wheat ſtubble, upon which the grips are ſupported, lie the hollower from the ground, and conſequently are eaſier dried by the ſun and wind: for it is to be obſerved, that the fatter and richer the ſoil is, the ſooner the grips will grow after they have taken wet, if they lie upon the naked ground; much ſooner than they would, in the ſame caſe, in a hilly country, where the land is poor. Beſides, huſbandmen there eſteem it an advantage, that they can ſtow a greater number of ſhort-cut ſheaves in their barns, thinking the loſs of the ſtraw compenſated by the excellent thatch which they make of the ſtubble; while, in other places, as in the Iſle of Thanet for inſtance, they mow it, for drying malt: and here we uſe it for littering our cattle, and pigs, and for covering to ſtraw yards, by which it is ſpeedily converted into moſt excellent manure, and increaſes our mixens.

The forwarder the harveſt is, and the warmer the ſeaſon is, the longer the corn may ſafely lie in the field, either in grips, or ſheaves: for this expoſure to the air, after it is cut down, mellows it, and makes it threſh better, and look finer. Thus, when the wheat-harveſt takes place from the middle of July, to that of Auguſt, there can be little danger in letting the wheat lie abroad four or five days, if it be not over ripe when cut, even though a rainy day or two ſhould come: for at that time of the year, the ſun is ſo powerful, the days are ſo long, the graſs and weeds ſo ſhort, and the dews generally ſo little, that the corn dries ſoon; whereas, from the middle of Auguſt to the beginning of September, the rains are more frequent, the dewy nights grow ſo long, the graſs and weeds are ſo rough, and the ſun's power ſo much abated, that the corn which lies out then will be vaſtly more apt to grow.

Mr. Liſle adviſes not to bind the grips of wheat into ſheaves too early in the day, particularly in hilly countries; becauſe, in ſuch ſituations, the grips take ſo much damp, by having laid on the ground, that though the ſtraw, and chaffy ears may ſeem to be dry, when the dew is firſt gone off, and after the ſun may have ſhone an hour or two, yet there will remain an inward dampneſs in the corn and ſtraw, which, if laid up in that condition, will come damp from the rick, or barn, at threſhing time. The afternoon is therefore much the beſt time for binding into ſheaves; taking care to finiſh the work before the day is over. The bands ſhould, however, be laid in the morning, that they may not crack: for the ſtraw will not twiſt after the ſun is up, but will be brittle, and break off below the ears. The turning of ſome of the bottom ends of the ſtraw to the ears of the band, will help its ſtrength and toughneſs.

The bands ſhould not be laid down but in fair weather; for being preſſed down by the grip, or two, which it is neceſſary to lay upon them, to keep them in their places, and prevent their being untwiſted by the ſun, they will grow ſooner than any of the other corn: for, if wet by rain, they cannot dry, from their lying undermoſt.

The binders ſhould not be ſuffered to tie the ſheaves juſt under the ears, inſtead of binding them at the other end; the conſequence of which is, that they will hardly hold together to be flung into the cart at harveſt, and will certainly be in great danger of falling to pieces before they are threſhed.

If a little rain is foreſeen in harveſt time, it is beſt to bind the grips into ſheaves, as faſt as they are made; becauſe ſmall ſhowers will wet the ſingle grips ſo much, that they cannot be bound up; and thoſe ſhowers may be the forerunners of great rains. The ſheaves being bound, will ſoon dry after ſuch wet. But if a hard rain is foreſeen, the beſt way is, not to bind into ſheaves; becauſe they will then be wet to the bands, and muſt all be opened again.

Farmers agree, that rain which comes with a driving wind is the worſt weather for ſheaves of wheat in the field; even worſe than a downright ſoaking rain.

In a wet harveſt, ſmall ſheaves are beſt; becauſe, being thin at top, and falling cloſe, the rain does not ſo eaſily ſoak down to the middle of them, and go through to the bands; as it is apt to do in great ſheaves, which lie broader, and take a larger compaſs. When there are many weeds mixed with the corn, ſmall ſheaves are then beſt, becauſe the air, wind, and ſun, can ſooner dry them.

Reapers ſhould take care in placing their grips, to lay the ſtraw end in the furrow, and the ears out; becauſe they will then lie ſloping up, and be tolerably dry, even though rain ſhould fall.

The ſtraw of blighted wheat, being hollow, and ſpungy, is very apt to imbibe moiſture; for which reaſon, the beſt way is, to houſe ſuch corn as ſoon as it is tolerably dry, eſpecially if there be the leaſt proſpect of rain: for if ſtraw of that looſe texture be once ſoaked with wet, and ſhowery weather ſhould afterwards come on, it would with difficulty be got dry enough for threſhing.

If the directions before given for plowing have been ſtrictly adhered to, the farmer will find his land in a very looſe ſtate, even after his crop of wheat is taken off.

Narrow wheels on ſuch land would be found extremely incommodious; as they would cut the ſurface, and increaſe the draft. Broad wheels are therefore of great advantage, both over plowed, and graſs fields, when ſubject to wet.

It has been found from experience, that wheat keeps better in the ſtack unthreſhed, than when its grain is laid up in granaries: beſides which, another advantage attending the ſtacking of this corn is, that the huſbandman need not threſh it, till the markets, or other occaſions require; whereas, if it were houſed in the barn, he would not be able to ſave it from the deſtructive vermin which harbour in ſuch buildings.

To guard againſt thoſe enemies, and againſt the dampneſs of the ground, which has alſo been found to do great damage, fix in the earth of the rick-yard, a central poſt of wood, three or four feet high, and at equal diſtances from the center, and from each other, ſink in the ſame manner eight other poſts, over which place croſs pieces, like joiſts, and joiſts alſo from the center to the ſide-poſts. Theſe joiſts muſt be pretty ſtrong, the weight they have to bear being very great; and for this reaſon, it will alſo be neceſſary, that every poſt which is ſunk ſhould be ſupported by a large root, or ſome flat ſtones, or flints put previouſly into each hole, by way of foundation. This being done, lay the ſmalleſt pieces from joiſt to joiſt, and over them ſome bruſh-wood, or branches, to prevent the ends of the ſheaves from falling through. Over the top of each poſt, and under the joiſts or timbers, a piece of oak, or elm-plank, about two feet diameter, and two inches thick, ſhould be placed. Theſe may be kept in their places, by making a hole through their center, and a hole alſo bored down a little way into each poſt, and then by driving a wooden peg through the plate, or plank, into the poſt, it will prevent their being ſhifted from their ſituation. Theſe plates being flat, and ſmooth on the under ſide, hinder the vermin, ſuch as rats, mice, &c. from climbing up the poſts, and lodging themſelves in the corn. And when the ſtack is built upon this ſtand, care ſhould be taken to have every ſheaf ſhaken a little, to try and diſlodge any field-mice, which may have already taken refuge in the ſheaves, while lying in the field, and which have been known to commit very great havock, in ſpite of all precaution. It is a bad way to make theſe ſtands ſo high, as to become ſheds for putting carts, or other implements underneath; becauſe country ſervants, who are famous for ſtupidity and careleſſneſs, will, by miſplacing theſe inſtruments, give vermin every opportunity of making good their lodgements, by getting up to the bottom timbers, or joiſts, and penetrating from thence into the body of the ſtack.

Some are at the expence of making their poſts, or piers, of brick work, and of coping each pier with flat ſtones, wrought ſmooth. Others, deſirous of ſtill more durability, have ſtone poſts cut of a ſugar-loaf form, which they place on foundations of rough ſtone or brick work, and cap with circular flat ſtones; over which is placed a floor, regularly framed with fir or oak, and made to laſt for a very long time. The beſt built ſtacks I ever

I ever ſaw, were at Mr. Ducket's, at Eſher. They were ſupported by four piers only, which formed a ſquare of about eight feet. A ſtrong floor lay over theſe piers, and upon that floor were laid the ſheaves, which were gradually changed from the ſquare to the circular form, and were ſwelled out by degrees, till they overhung the floor at leaſt eight feet all around, making the ſtacks twenty-four feet diameter at the eves, from whence they were ſloped up to a point at top. Theſe, where expence is not grudged, are beſt of all: and when a ſtack of wheat is well built on ſuch ſupporters, with the bottom ends of the ſheaves outward, and the top is ſkilfully thatched with wheat-ſtraw, which is beſt for this purpoſe, the corn may there remain, in great ſecurity, for many years.

Particular care ſhould be taken in ſtacking wheat, always to lay the ear ends of the ſheaves inward, and upon a riſe, ſo as to keep the middle of the ſtack full, while it is wrought up: for in this caſe, when it ſettles, the ſinking will be chiefly on the outſide, which will thus become cloſer, and the ſtraw ends being outward, and at the ſame time inclining downward, birds cannot get at the grain; nor can rain be driven up to the ears. The ſhorteſt and thinneſt ſheaves ſhould be uſed in the topping of the ſtack, becauſe it cannot be ſo conveniently drawn in and narrowed, with great long ſheaves. Oats, or ſome other coarſe grain, is ſometimes uſed on the top of the ſtack, under the thatch, the better to preſerve it from wet.

The ſtraw of oats is naturally ſo ſmooth and ſlippery, that it is apt to ſlide in the ſtack, which then frequently tumbles down, eſpecially if it was very dry when carried in. An oat-rick muſt not, therefore, be widened beyond its foundation, which is generally of faggots; nor ſhould its ſides ever bulge out, but be gradually contracted. Barley, having a rough ſtem, may be piled more upright.

When ſparrows rooſt at night in holes under the eves of a ſtack of corn, it is reckoned a ſure ſign that there are neither rats nor mice in it; for their ſqueaking and running about in the night would ſo diſturb the birds, that they would not remain there.

Having now given an account of every uſeful circumſtance I can collect, either from my own experience, or that of others, relative to the culture and management of wheat; not only of thoſe articles which muſt be attended to in the old huſbandry, but of many which are alſo neceſſary in the new, or what is commonly called the horſe-hoeing huſbandry; a ſpecies of cultivation ſuperior to the former in every point of view; it now becomes highly neceſſary that we proceed to examine and deſcribe its advantages, with that care

and

and accuracy which a ſubject ſo intereſting demands.

England, ſays Mr. Mills, may juſtly boaſt of having given riſe to one of the greateſt improvements in agriculture, that has ever been made in any age. Mr. Tull is undoubtedly intitled to the honour of having firſt thought of beſtowing upon corn that culture which had been found neceſſary for the vine, and other perennial plants, or what is uſually called the horſe-hoeing huſbandry; and in the proſecution of this plan, he gave proofs of the utility of thorough plowing, much beyond whatever was thought of before. Though in him we find a ſtrong inſtance of the partiality of the human mind in favour of its own productions, by his rating the advantages of plowing, or what he calls pulverization, ſo high as to render every other aſſiſtance unneceſſary; yet poſterity will ever be indebted to him for having firſt planned this truly ſenſible and beneficial practice.

Experience ſhews, that land, though ever ſo well tilled in the autumn, yet, during the courſe of the winter, hardens and ſaddens after the wheat or other grain is ſown. Its particles, beaten down by heavy rains, and ſunk by their own weight, approach each other more and more every day; the roots of the plants have conſequently leſs and leſs room to extend themſelves, in queſt of their neceſſary food; and the interſtices in the earth, become of courſe ſo few, and ſo cloſe, that the tender fibres are not able to pierce through them; whilſt weeds ſpring up, and rob them of air, and of nouriſhment. By theſe means, the earth, reduced to nearly the ſame condition, as if it had not been plowed at all, is unable to aſſiſt the plants ſown in it in the ſpring, when they ought to ſhoot with the greateſt vigour. They then conſequently ſtand moſt in need of the plough, to deſtroy the weeds, to lay freſh earth to the roots, in lieu of that which has been exhauſted, to break the particles of the ground anew, ſo as to enable their roots to ſpread, and even to cut off ſome of the ſmaller fibres, in the room of which they ſend out others ſtronger, and in greater number; all which tends to their collecting a more ample proviſion of food, which at that period particularly does them the greateſt ſervice.

In the common huſbandry, the whole of the attention is, to provide a great ſtore of nouriſhment for the wheat, at a time when it ſcarcely conſumes any, as it then produces only a few blades; after which it is left to itſelf at a ſeaſon, when it might, and ſhould, be moſt aſſiſted by proper culture; a management as prepoſterous, as it would be to give a child a great deal of food, and diminiſh it gradually as it grows bigger.

The great advantage of having land in fine tilth before it is ſowed, is univerſally acknowledged: but we muſt not ſtop at thoſe firſt preparations. Plants require a continuation of culture while they grow, and muſt not be neglected till they have attained their full maturity.

Many have objected to the frequent plowings uſed in the new huſbandry, from an apprehenſion that the moiſture eſcapes more eaſily from a well looſened ſoil, than from a hard and cloſe earth. But, on the contrary, it appears from every experiment, that, even in the drieſt weather, land cultivated according to the new method, continues conſtantly moiſter, than that which is managed in the old way. Inſtead of a ſtagnant wet, more hurtful than beneficial, to moſt plants, earth made fine to a good depth is prepared, as the Rev. Dr. Elliot expreſſes it, with open mouth, to drink and retain the dew, which, when it falls upon the land that is untilled, or but poorly tilled, does not ſink faſt, but is carried off by the next day's ſun.

That dew is one of the greateſt fertilizers of the earth, both from the moiſture it affords, and from the mucilage it contains, has been repeatedly proved; and that it will penetrate ſo deep in a fine looſe ſoil, as to keep that moiſt, while the ground around it is parched up, is clearly demonſtrated, by Mr. Tull's following experiment.

Till, ſays he, a field in lands for ridges, make one land very fine, by frequent deep plowings, and let another be rough, by inſufficient plowings, alternately: then plow the whole field acroſs the lands, in the drieſt weather, which has continued long, and you will perceive, by the colour of the earth, that every fine land will be turned up moiſt; but every rough land will be dry as powder.

If ſeveral rows of wheat are ſown in a poor, but well plowed land, the blades of corn will turn yellow in the ſpring, eſpecially in dry weather. Let the earth bordering on theſe rows be plowed deep, in ſome places near, in others farther from the rows, and the plants will reſume their proper colour; firſt in the places neareſt to the new plowed ground, and afterwards gradually in the others, according to their diſtance: which proves that they recover their verdure, in proportion as their roots reach the looſe mould. This holds equally true in all plants: for Mr. Tull declares, that he does not remember to have ever ſeen a poor one, contiguous to a well-hoed interval.

Our reaſon tells us, that the longeſt lived plants ſtand moſt in need of this culture. Perennials require it more than annuals; and wheat, which is ſown in autumn, and does not ripen till nine months after, wants it more than ſpring corn, which occupies the ground only for a few months. The former has to conquer a ſoil rendered hard during the courſe of the winter, but the other has not that difficulty to ſurmount; though both of them, and indeed all ſorts of plants, are greatly invigorated by the repeated ſtirring of the land, and laying fine freſh earth to their roots.

In order to begin the operations of the new huſbandry to advantage, the land muſt be in perfect tilth, and free of weeds: I ſhall therefore ſuppoſe that the fields to be cultivated in this manner have been prepared by ſummer-fallowing. This is, indeed, a fundamental rule, without which every attempt muſt prove abortive.

Before I proceed farther, it is neceſſary to obſerve, that the great ends at which we aim by the new huſbandry are, 1. To have an excellent crop from our land, both as to quantity and quality; 2. To prepare that land for another good crop, either of the ſame grain, or of any other corn or pulſe we chooſe; 3. To prevent the neceſſity of ſummer fallows, which loſes a crop every fourth or fifth year. Theſe are the deſiderata; and that they may be accompliſhed, is now perfectly aſcertained,

tained, as I hope to be able to demonſtrate in the moſt ſatisfactory manner.

In order to practiſe the horſe-hoeing huſbandry, the farmer muſt be provided with a good drill-plough, ſuch as I have before deſcribed; and with the other implements recommended in the courſe of this work.

To anſwer the ends of this huſbandry, the ſeed muſt be diſtributed ſo ſparingly, that each plant may have room to extend its roots in ſuch manner, that they may be able to collect an abundant ſupply of food. Each plant muſt be enabled to tiller greatly, ſo as to produce a conſiderable number of ſtalks; and each ſtalk muſt be enabled to bear a fine long ear, well filled with grains to its very point.

Farmers ſeem generally to object to wheat as the firſt crop after a ſummer-fallow, where the land has been dunged; becauſe, they allege, that land freſh dunged is one of the cauſes of ſmut.

I cannot ſay I am of this opinion, if the dung is well rotted, well mixed, and properly ſpread and plowed in, ſome days before the ſeed is ſown. However, for thoſe who feel this objection in imagination, or who found it in experience, it is right to remove it by taking a firſt crop of turnips, or winter-tares, which being drilled and

horſe-hoed,

horſe-hoed, will ſtill farther improve the land for a ſucceeding crop of wheat.

The beſt and moſt œconomical diſtance at which the rows of wheat ſhould be drilled, has never yet been perfectly aſcertained. The deſiderata are, to loſe as little ſpace as poſſible for the corn, and at the ſame time to reſerve enough for the purpoſe of horſe-hoeing to beſt advantage.

Previous to the fixing of any diſtance, the farmer ſhould determine the future deſtination of the field. If, for inſtance, it be only required to have the beſt and moſt plentiful crop of wheat, without any particular view to the enſuing crop, it will in that caſe be ſufficient to have the rows from nine to twelve inches aſunder, which may be managed altogether by the proper uſe of Mr. Cooke's excellent implements. But if, on the other hand, the field be intended for a continuation of wheat-crops, or if it be intended for any intermediate cropping of pulſe, or roots, between the rows of wheat, it will in thoſe caſes be found neceſſary to leave a much more conſiderable diſtance; from two and a half to three feet is not too much. Theſe rows may be ſown with Cooke's drill-plough; but his hoes will be inſufficient for ſo large an interval. I would therefore recommend a light Rotherham, or Suffolk plough, for this purpoſe; with which a furrow ſhould be taken from the right-hand row, and thrown into the middle of the interval, and another from the left-hand row, and that likewiſe thrown into the middle of the interval.

The ſeed ſhould be ſelected and prepared as formerly mentioned, and the quantity to an acre muſt be regulated by the number of rows, or width of the alleys; but, at moſt, it ought not to exceed one buſhel and one peck Wincheſter meaſure.

The land ſhould not be ſowed later than the middle of September, and ſhould not have its firſt hoeing, as above directed, before the end of October; taking the opportunity of dry weather. The ſecond hoeing ſhould be given as ſoon as the hard froſts are over, that is, in the firſt fair weather in March, by ſplitting the mould laid up in the middle of the intervals, and throwing it back on the ſtems of the plants on each ſide, by means of a horſe-hoe, or ſmall plough with a chiſſel ſhare, and double mould-board. This ſecond hoeing, giving freſh earth to the roots of the plants, makes them tiller, and grow ſtrong and healthy. For this earth, having been mellowed during the winter, will afford excellent nouriſhment at a time when it is moſt wanted; that is, when the plants begin to vegetate apace, and put forth their multiplied ſtalks.

The third hoeing, which is the ſecond after winter, is intended to ſtrengthen the ſtalks, and ſhould be performed when the ears of corn begin to appear. This culture is looked upon as the leaſt important of all, and is even ſometimes omitted, without any great inconvenience. A ſlight ſtirring of the earth, even with the hand-hoe, need therefore only be given in the middle of the alleys, to keep the mould looſe, and free from weeds.

The fourth, and laſt ſtirring of the earth between the rows of corn, is one of the moſt important, being that which makes the grains ſwell and grow full bodied to the very point of the ear.

The moſt proper time for this is, when the ears begin to bloom: but as the corn is then high, only one furrow can be cut in the middle of the alleys, the earth of which ſhould be laid up to the ſtems of the plants on each ſide, in as great quantity as the depth of ſtaple will admit of.

By this operation, the fallowed alleys are prepared for the next crop; for it is in the middle of them that the corn is to be ſown the year following; and the now eared wheat is thus earthed up, to prevent its being lodged; though, in general, corn thus cultivated is leſs apt to be beaten down, than that which is raiſed in the common way; becauſe the ſtraw of this, being more expoſed to the air, becomes harder, and acquires a firmer texture, eſpecially towards its bottom. It is for this reaſon that a tuft of corn, which ſtands quite ſingle, is ſcarcely ever beaten down by the weather.

Corn raiſed thus muſt be reaped; the unevenneſs of the ſurface makes it impoſſible to mow it. All poſſible care ſhould be taken to prevent the reapers from treading down and conſolidating the looſe mould.

It is well known, that vigorous plants do not ripen their ſeeds ſo ſoon as thoſe which have been ſtunted in their growth. For this reaſon, the corn cultivated according to the principles of the new huſbandry, ripens later than in the common way, and ſhould therefore be ſown ſomewhat earlier.

I will now ſuppoſe the crop is reaped, and that the ſame field is again to be ſown with wheat, not only the year following, but for ſeveral ſucceeding years: which may be done with ſucceſs, becauſe the rows of corn occupy new ground, by being placed each time in the middle of the former alleys, which have been well plowed for a whole year, without producing any thing. Thus, one great difference between the new and the old huſbandry is, that inſtead of fallowing a whole field, while another whole field is under corn, the fallow here is in the ſame field with the crop, being interſperſed alternately. But there are many great advantages in this new way, which the other cannot enjoy, namely, that here every crop has the benefit of having the mould ſtirred for its roots to ſpread in, three or four times in a ſeaſon, by which means it is not only invigorated, but kept clear of rival and baneful weeds; beſides, it is more expoſed to the influence of rains, dews, and air, which afford the greateſt part of its food: for without air, and without moiſture, plants cannot exiſt, no more than animals: like them too, they exhauſt the air, render it effete, and muſt have a conſtant and freſh ſupply.

If it be thought proper to manure the land for a new crop, either of wheat or pulſe, the dung, which ſhould be completely rotten and mellow, muſt be laid in the bottom of the deep furrow laſt formed in the center of the alleys, and ſhould there be covered with the mould thrown up to the rows of wheat. This dreſſing is not given till the crop is off the ground; and if the land is thought to be in ſuch condition as not to require it, then this deep furrow is filled by replacing the above mould with the plough. This ſhould be done immediately after the harveſt, that there may be time to give the land another ſtirring, which need only to be a ſlight one, before the ſowing of the rows, which are now to be in the middle of the former alleys; and the alleys of this year will be in the place of laſt year's ſtubble, as was before obſerved.

Though land cultivated according to the new huſbandry does not require ſo much dung as that which is managed in the old way, yet this manure will always help to enrich the ſoil, eſpecially if it be uſed in the manner here directed. By being thoroughly rotten when it is laid in the furrow, and covered over immediately after harveſt, it will have time to diſſolve into mucilage, and to diffuſe its juices, and not be apt to choak or interrupt the ſhares of the drill; an inconvenience which might take place, were it full of uncorrupted ſtraw, or other matter.

It is farther to be obſerved,

1. That if dung be uſed for the ſecond year's crop, very little of it will ſuffice; becauſe, it need only be laid in the bottom of the furrows.

2. That the ſecond year's wheat is placed in a moſt advantageous ſituation; its roots having a depth of ten, twelve, or fourteen inches, to extend themſelves in, by means of the furrow which was in the middle of the alley: for this reaſon, corn ought to thrive beſt in thoſe lands which have been longeſt cultivated in the new method.

3. The earth in the alleys is to be horſe-hoed during

ing the ſecond year, in the ſame manner, and at the ſame ſeaſons, as in the firſt.

I am aware that this excellent mode of cultivation is not without its difficulties and objections. It may, for inſtance, be alleged that ſpaces which admit of ſuch cultivation, will greatly reduce the produce of an acre of land, and that it would be attended with great expence, for the ſmallneſs of ſuch a produce. There is alſo ſome difficulty in placing of the rows on the ridges, ſo as to have an equal number every ſeaſon. In order to accompliſh this point, the rows muſt be ſown ſomewhat irregular on the ridges; that is, one row muſt be nearer to the furrow on one ſide of the ridge than on the other. To explain this, let us ſuppoſe the ridges three-ſtep lands, or ten feet ſix inches wide; one row of the corn muſt be ſown at one foot from the center of the furrow: from the firſt to the ſecond row I ſuppoſe two feet and a half, from the ſecond to the third the ſame, from the third to the fourth the ſame, and from the fourth to the centre of the furrow two feet remains. So that when one row ſtands one foot from the furrow on one ſide of the ridge, the other will ſtand two feet from the furrow on the other ſide of the ridge. Then the next row on the ſecond ridge will be again one foot diſtant from the furrow; and thus every furrow-interval will be three feet wide, when the other intervals, or alleys, will be only two feet and a half wide; and every year the poſition will be reverſed. This, it is true, does not bring the rows of the ſecond year exactly into the center of the firſt year's alleys, but brings them ſo near that the difference is of little conſequence; and if thought of conſequence, it may be remedied by keeping the ridge ſomewhat wider.

Upon this ſubject I will here give another mode of proceeding, practiſed by a very intelligent farmer, and drawn from the Bath Society's papers, of which Society the author is a very inſtructive correſpondent.

Mr. Anderſon drills two rows, a foot aſunder, and a ridge five feet wide; of courſe leaving intervals of four feet for horſe-hoeing. The ſeed is ſhed in the rows promiſcuouſly, but regularly, by Willy's drill-plough, at the rate of from two pecks to a buſhel per acre; and he is of opinion, the medium between theſe two, is preferable to either extreme, if the land is well tilled, and the ſeed ſown in proper ſeaſon, having due time for plants to tiller.

The wheat was drilled on the ſame ground every ſecond year, and Mr. Anderſon continued that mode eleven years ſucceſſively, on ground worth from five to twelve ſhillings per acre, with calcareous ſtones in it. His tenth crop produced eighteen buſhels an acre, and his eleventh crop ſixteen buſhels an acre; after great devaſtation from mice: the crop remaining in the mow almoſt two years.

He manured the ground, for the firſt crop, with four hogſheads of lime, and about eleven cart, or put loads of that country, of rotten dung, at the expence of twenty ſhillings and four-pence per acre. For the ſixth crop, he manured again with twenty hogſheads of lime an acre, mixed with forehead-earth, that is, head-lands dug up, with the rubbiſh of an old lime-kiln, at the expence of one pound nineteen ſhillings an acre; and he uſed no other manure for eleven crops, ſowing about twenty loads of earth, and rubbiſh at another time, on a ſmall portion of the field, where the natural ſoil was remarkably thin; which, if charged with the whole field, will not be two ſhillings per acre. Then, the whole expence of manure for eleven years, did not exceed five ſhillings and ſeven pence an acre per annum.

Mr. Anderſon ſometimes plowed, or horſe-hoed his alleys only twice, during the growth of his crop: but it ſhould have been repeated three or four times. The earth cannot be kept in too friable a ſtate, when the crop is in early enough, and the weather will permit, he has plowed, or horſe-hoed before Chriſtmas; then he plows again as early as he can in the ſpring; then a third time, when the ear begins to ſwell in the ſtem; and a fourth time, immediately before the bloſſom is come out, or as ſoon as it is gone; and theſe four plowings, or horſe-hoeings, he thinks neceſſary to do juſtice to that mode of huſbandry; yet is ſorry to ſay, that to his loſs he has ſeldom fully complied with them.

At the end of the above-mentioned eleven years Mr. Anderdon found his ground, with the manure above mentioned, greatly improved; and is of opinion, that after the above mode of cropping for eleven years, had he carried no more manure on the ground, it would have been made more fertile than at the beginning; but he does not think that in ſuch a caſe he ſhould have had crops as profitable as with manure; yet he thinks it abſolutely neceſſary to avoid manuring ſuperabundantly for wheat crops, leſt they ſhould run to ſtraw, and become thereby unprofitable.

Mr. Anderdon's crops have been from nineteen to nine buſhels an acre, per annum; the average of the eleven crops fourteen buſhels. The crops of wheat in the ſame pariſh, taking the good with the bad ground (and ſome runs to one pound per acre), were on an average no more than fifteen buſhels an acre.

It ſhould be obſerved, that, by the drill mode, a buſhel of ſeed per acre, at leaſt, is ſaved; and the advantage of a wheat crop every year, and alſo keeping the ground clean, and in good heart, with little manure.

N. B. When the crop was only nine buſhels, it happened from ſteeping the ſeed, according to Reynolds's method, and it was overdone: by which means two buſhels were increaſed to three; and a very wet ſeaſon following, the ſeed was in great part burſt and deſtroyed.

By this culture, the berry, or grain, is certainly larger, fuller, and more perfect, conſequently heavier in every ſenſe. This agrees with the accounts of the grain produced by ſetting.

As the ſmut has not affected Mr. Anderdon's crops, but attacks chiefly weak corn; and as in this mode of huſbandry you may ſow ſoon after harveſt, and horſe-hoe almoſt at pleaſure; he thinks it moſt likely to prove its prevention, removal, or cure. Change of ſeed, and brining, are alſo recommended by him to prevent it.

For the blight, as there are ſeveral ſorts, ariſing for the moſt part from poverty, all ſuch Mr. Anderdon ſuppoſes the horſe-hoe would remedy; but as to that ſpecies which ariſes from plenitude, he ſuppoſes this huſbandry muſt be, in a degree, liable to it, as well as the old: yet he thinks frequent horſe-hoeings, as they retard the immediate growth, and haſty running-up of the plant, would in the progreſs, if repeated with judgment, ſtrengthen the ſtem, and abate, if not prevent, that weakening and falling of it, which might otherwiſe occur from repletion and haſty growth.

His corn has been ſlightly attacked by the mildew, but never yet ſo powerfully as that of his neighbours.

Mr. Anderdon thinks the drill-plough, judiciouſly uſed, a very great acquiſition to agriculture. He is of opinion, from experience, that the uſe of it is the beſt method, not only for putting in wheat ſeed, in the horſe-hoeing, or Tullian method; but alſo, when the whole field is ſeeded with that grain, ſowing it in ſuch caſe in equidiſtant rows, nine or ten inches, or one foot aſunder.

In that way too, it is beſt for ſeeding ground with barley, oats, or vetches. The ſeed will be leſs, the crops more certain and larger. It is alſo beſt for putting in turnip-ſeed, and horſe or tick beans; both of which he would recommend to be ſown in ſingle rows, three feet aſunder, horſe-hoeing the intervals: peas may be better ſupported ed in double rows, one foot aſunder, on five feet ridges.

Succeſſive horſe-hoed crops of wheat are profitable, but he is rather inclined to think, the horſe-hoeing huſbandry would be moſt profitably carried on by a change of crops; and that turnips on a good fallow, drilled in ſingle rows, three feet aſunder, or more, till the ground is in perfect tilth, would be a good crop to begin with; and if dung, or other manures can be had, they can ſcarcely, for that crop, be too plentifully applied; but on reclaiming large extents of land, muſt in great meaſure be diſpenſed with. Then ſhould follow ſuch drilled crops as beſt ſuit the ſoil and ſituation, and the farmer's occaſions, whether according to the Tullian mode, or in equi-diſtant rows; and ſhould it be barley, or oats, in the latter way, it will be remarkably favourable to the graſs ſeeds, if any are ſown with them. But a great reſpect and conſideration ought always to be had in favour of the Tullian mode, from the vaſt advantage ariſing by the ground being clear of weeds, which advances in proportion to the length of time that the ground has been well managed under that mode, and not made foul by carrying into it the ſeeds of weeds with dung or manure. Therefore Mr. Anderdon ſtrongly recommends to the farmer, whoſe ground is well adapted to wheat crops, to introduce them in the courſe of crops in the Tullian mode, and to take two, three, or four ſucceſſive crops of them, which may as well be taken as one.

Mr. Anderdon is of opinion, that there are in England millions of acres of land uncultivated, that would admit of being greatly improved upon the principles of the new huſbandry, not too haſtily, or inconſiderately exerciſed. It always, in the firſt place, requires a fallow, and perfect tilth; if very foul and rough, it ſhould have two years fallow before it is cropped; and if very poor, will require, and pay amply for ſome manure, if attainable. But the plough and manure may often be too much for corn-crops; and it is abſolutely neceſſary to ſuit your crops to the nature of your ſoil, and the ſtate it is in. He imputes the ſmall progreſs the drill-plough has made in agriculture, to the want of attention to thoſe particulars; ariſing chiefly from the adventurer's being too ſanguine and haſty to execute his new project, and actually doing it before his ground is in order: of courſe the crop fails, and the drill-plough is no more heard of.

Whatever objections may be raiſed to this mode of cultivation, I will venture to pronounce in its favour, that I know of none, by which land will be kept ſo clean, or in ſuch perfect tilth, and good

good heart, for producing uninterruptedly excellent crops of wheat.

But if, notwithſtanding this juſt panegyric on the method of cultivation I have now deſcribed, other, or alternate crops, ſhould be preferred, it is highly proper that we ſhould take an accurate view of thoſe alſo, in order that every farmer may have in his power to adopt the method which pleaſes him moſt, or indeed to try any, or all of them.

Many farmers have been ſatisfied to admit of alleys, or intervals of eighteen or twenty inches wide, and have only horſe-hoed once during the ſeaſon, that is, in the month of March, before the wheat was ſo high as to be hurt by the horſe's feet; for it is not eaſy to confine them always within ſo narrow a track. As this hoeing may be given with a very light chiſſel-ſhared plough, and double mould-board, and as the earth is, or ſhould be light, from its fine tilth, a thought has often occurred to me, whether aſſes might not be made to do this buſineſs well; they are ſure-footed, tread narrow, and have ſufficient ſtrength for this work. They might alſo be extremely ſerviceable for many other purpoſes about a farm, ſuch as rolling, buſh-harrowing, carrying of chalk, dung, mould, and twenty ſuch uſeful and toilſome taſks, which naturally occur in every farm, and might be done at ſmall expence by theſe very hardy and laborious animals.

To ſuch a crop as the above, ſowed with ſuch narrow intervals, the other neceſſary hoeings might be performed with the hand-hoe, for which I have generally paid four ſhillings and ſixpence per acre.

Other farmers have judged it more expedient to drill-ſow their wheat in rows, at nine, ten, or twelve inches diſtance, and to truſt the culture, and keeping of it clean, to the hand-hoe alone. Where the extent of wheat ſowed is great, this is a moſt expenſive and vaſt operation; but at the ſame time, when hands can be procured to perform the work, there is no doubt but it will anſwer as well on a larger, as on a ſmaller ſcale.

I have already mentioned in the article of Sowing, Mr. Cooke's drill-plough, and have there given ſo full an account of it, that it would be perfectly ſuperfluous to add any thing more here, except it be to ſay, that upon clean land this is the mode of culture I would certainly prefer to all others, as being productive of the largeſt crops at leaſt expence, and giving an excellent opportunity of introducing annually alternate, and ameliorating crops, by which the land is kept in great vigour.

Very large experiments have now been made with this plough, all of which have proved ſucceſsful. Thoſe indeed of Mr. Boote, in the years 1786 and 1787, are ſo extremely extenſive, that they leave us no room to doubt of his good opinion of it. I have formerly ſtated the quantities ſown by him in theſe years, with this implement, and ſhall here add his own account of the reſult of that culture.

Account of the different ſorts of grain produced from ſeed ſown by Mr. Cooke's drill-plough; ſent by Mr. Boote to the Society in the Adelphi, London.

		Buſh.	Gal.	Pts.
	No. 1. Wheat growing on loamy ſand after beans, produce per acre	47	0	0
	2. Ditto growing on cold clay, after beans....................	44	5	4
*	3. Ditto growing on cold clay, after beans....................	25	4	2
	4. Ditto ſown broad-caſt, after beans........................	9	4	4
	5. Peas growing on light ſand, after barley......................	50	2	1
	6. Barley growing on light land, after turnips.................	72	4	1
	7. Beans growing on loamy ſand, after barley..................	36	2	4

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* Very inferior ſoil.

This account is atteſted by J. Townſend*.

The whole of this account affords ſuch complete ſatisfaction upon all the intereſting points of the buſineſs, that I am convinced, if it were generally known and underſtood, it would do a great deal towards rendering the drill-huſbandry, on this plan, univerſal.

Mr. Boote, in his ſecond account to the Society of Arts, &c. in London, has given a farther confirmation of the ſucceſs of his very intereſting experiments in the drill-huſbandry, and has alſo favoured us with an accurate ſtatement of the reſult; which I ſhall here inſert as ſuccinctly as I can.

On peruſing the conditions held out by the London Society, for a premium for aſcertaining the moſt advantageous method of cultivating wheat, by drilling or broad-caſting four acres of each; Mr. Boote took an opportunity of making the experiment in the following manner. At the time he was drilling his land with wheat, being about twenty-one acres in one piece, his next neighbour was ſowing in broad-caſt a piece of land of about eleven acres, adjoining to it; the ſoils of both, of the ſame quality, viz. a loam, only divided by a fence: the preparations of both pieces, for wheat, was the ſame, viz. beans; with this difference only, that his neighbour's land was dibbled in and hoed, his was drilled and hoed; his neighbour's was alſo manured for wheat after the beans, his own was not manured at all; his neighbour's was ſown broad-caſt with twenty gallons of ſeed to the acre, his own was drilled with nine gallons and a half to the acre. During the growth of theſe two crops, every attention was paid to the comparative experiment, not only by himſelf, but many others. Until the firſt hoeing of the drilled wheat was performed, the broad-caſt ſeemed to have the advantage, from a greater number of plants appearing upon the land; but in a few weeks after the drilled wheat was hoed, in the month of March, it exhibited a prodigious increaſe of ſtems, more vigorous of themſelves, and of a darker green than the broad-caſt; which preference was maintained till the time of harveſt. A little before harveſt, both crops were viewed by many judges, and unanimouſly determined in favour of drilling, in the proportion of three to two.

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* Lond. Soc. Tranſ. Vol. V. p. 80.

The reſult of the firſt experiment Mr. Boote made between drilling and broad-caſting upon a cold ſtrong clay, is already ſtated. The reſult of the ſecond will be found in the following account of the crops in the year 1787. From every obſervation Mr. Boote has made on the two laſt experiments on clays, and his former drilling on loams, he is inclined to believe, that there is hardly a piece of land to be found, that will not admit of greater profits by drilling and hoeing, than broad-caſting, provided that drilling and hoeing are properly attended to. In proportion to the additional labour and expence required in cultivating clay ſoils in the uſual way, compared with tractable loams; ſo he found the additional labour and expence of drilling and ſowing ſuch ſoils: at the ſame time it may be obſerved, that as clay ſoils are in general more productive than loams, particularly in beans, and wheat, there is no fear but the cultivator will be well rewarded by ſuch ſoils, for all his additional labour and attention.

In order to make a comparative trial between drilled and broad-caſt barley, Mr. Boote prevailed upon a neighbour, Mr. William Greenway, of Alſcott, to make an experiment upon a piece of land adjoining, and under the ſame cultivation as his own: and although the hoeing was not performed in due time, yet he authoriſed Mr. Boote to ſay, that his drilled barley yielded him ſixteen ſhillings an acre more, clear profit, than his broad-caſt crop yielded; and as a proof of his being a convert to the drill ſyſtem, he that year drilled two-thirds of his wheat crop, which looked as well as Mr. Boote's.

Mr. Boote fully intended to have kept an exact account of his expence of hoeing, in the year 1787, but found it impoſſible, from the number of people employed at different times irregularly. He, however remarks, that too much cannot be ſaid in favour of this practice; for by it thouſands of weeds are deſtroyed, which would otherwiſe ſtock the land, were their ſeeds ſuffered to come to maturity. Thus his neighbour's lands are growing fouler and fouler every day, while his become cleaner and cleaner, by having the weeds cut up when young: and this too prevents the neceſſity of a ſummer's fallow every fourth or fifth year, with the clear loſs of a year's rent, and much labour.

Upon ſuch of his lands as are already brought into a proper ſtate of cultivation, Mr. Boote is very certain he ſhall never need to make another ſummer-fallow; being fully perſuaded, that where drilling and hoeing are properly attended to, and two exhauſting crops never taken together, but an exhauſting and an ameliorating one, by turns, there is no neceſſity for it. If land be kept clean from weeds, and properly prepared by a ſufficient number of plowings at ſeaſonable times, the cultivator may reaſonably expect a crop equal to the production of the ſoil: from whence it ſhould ſeem, that drilling has every way the advantage over broad-caſting; for in a remarkably dry ſeaſon, when a broad-caſt crop is burnt up, and the cultivator only reaps a crop of weeds, ſuppoſing the drilled crop to ſuffer in the ſame proportion, which is in fact granting too much, for the grain of the drilled crop being depoſited at a proper depth in the ſoil, where there is moiſture, this crop will flouriſh, while the broad-caſt crop will ſuffer: but even ſuppoſing the drilled and broad-caſt crop ſhould ſuffer equally in a dry ſeaſon, if the cultivator makes all the uſe of the hoe, which a burning ſeaſon admits of, in deſtroying the weeds, and working the ſoil, and the crop, after all, ſhould fall ſhort of his expectations, he has the pleaſure, at leaſt, of ſeeing his land cleared of weeds, which will be the contrary with the broad-caſt crop, where the failure of a crop of corn is uniformly productive of a crop of weeds: he will have the ſatisfaction of conſidering, that in whatever proportion his preſent crop may fall ſhort of his expectations, if his land has been properly hoed, and kept clear from weeds, he has reaſon to expect that his next ſucceeding crop will be the more abundant.

When land is laid down with graſs ſeeds, it is uſual to ſow the ſeeds when barley is ſown: but in drilling, if graſs-ſeeds are ſown when barley is ſown, the hoeing cannot take place; therefore, ſooner than be debarred from hoeing, Mr. Boote determined to try the method which Mr. Cooke has publiſhed, of deferring to ſow graſs-ſeeds, till the ſecond hoeing of the barley was juſt going to be performed, about the beginning, or middle of May; and he can now ſay with pleaſure, that he could not wiſh to ſee a better plantation of young clover than he had growing upon ſeventy-two acres, ſown as above.

Mr. Boote had often heard it aſſerted, that there could not poſſibly ariſe any advantages from drilling turnips; but from the ſucceſs which he has had in drilling eighty-two acres, he is now of a very different opinion. The advantages chiefly conſiſt in depoſiting the ſeed at a proper depth in the ſoil, about two inches, where there is moiſture in a dry ſeaſon, to ſend the plants up in a few days; whereas, if they were ſown broad-caſt in a dry ſeaſon, the ſeed might remain in the ſoil ſeveral weeks, waiting for rain to make them vegetate; and the ſeed being depoſited at one and the ſame depth, will vegetate not only more expeditiouſly, but all at the ſame time; and by getting into the rough leaf the ſooner, will ſtand a better chance of eſcaping the fly. Mr. Boote would not however be underſtood to infer, that by drilling of turnips, the effects were entirely removed; notwithſtanding, in ſome very dry ſeaſons, it may ſo happen, by the plant getting into rough leaf before the fly begins to exiſt, by reaſon of the ſeed being depoſited at a regular depth, where there is a moiſture in the ſoil; but in regard to hoeing the turnips that are drilled, the advantages are conſiderable, the ſpaces between the rows could be hoed in half the time that would be required, ſuppoſing they had been ſown in the common way; and when they come to be ſet out at proper diſtances in the rows, the ſuperfluous plants will be cut out in one third of the time uſually employed, and that by women or children; this he experienced in his turnip crop, which was required to be hoed in the moſt buſy time of harveſt, and was done by women and children: whereas, if they had been ſown broad-caſt, he would have been under the diſagreeable neceſſity of ſending a number of his beſt hands to hoe turnips.

Mr. Boote concludes, by informing the Society, that for fourteen years he had never failed to raiſe a valuable crop of turnips every ſeaſon; and that he is tolerably eaſy in regard to any apprehenſions from the fly, which is conſidered as ſo formidable by moſt farmers.—Mr. Boote has not hitherto been ſo obliging as to favour us with his mode of management, which might have been of great ſervice.

Certified Account of Mr. Boote's Crops in the Year 1787.

No.		Land meaſured.			Produce.			Produce per Acre.		
		A.	R.	P.	Buſh.	Gal.	Pts.	Buſh.	Gal.	Pts.
1.	Beans drilled on loamy ſand after oats	0	1	27	24	2	3	58	0	1
2.	Wheat drilled on marle and mixed ſoil, after beans	0	1	4	9	7	2	36	0	1
3.	Wheat drilled upon loamy ſand, after beans	0	1	0	12	5	5	50	6	4
4.	Barley drilled upon loamy ſand, after turnips	0	0	38	17	7	6	75	5	2
5.	Barley drilled on ſandy land, after turnips	0	1	34	27	0	6	58	4	4
6.	Peas drilled on loamy ſand, after clover	0	1	9	15	6	3	51	4	5
7.	Wheat drilled on poor clay, after clover	0	2	26	16	7	2	25	4	1
8.	Wheat ſowed broad-caſt on poor clay, after clover, in the ſame ground.	0	3	24	12	4	1	13	7	2
9.	Wheat drilled on loamy ſand, after beans	0	1	6	13	1	0	45	5	1
10.	Oats drilled on ſandy land, after barley	0	1	8	22	5	1	75	3	6
11.	Oats drilled upon loamy ſand, after barley	0	1	29	33	1	1	76	6	6

Before I quit this ſubject, I muſt obſerve, that the hoe employed by Mr. Boote in hoeing all theſe crops, was one alſo invented by the Rev. Mr. Cooke, of a very ſimple conſtruction, like a breaſt-plough, to be puſhed forward by hand. The hoeing part of this implement is made nearly in the ſhape of a common large Dutch hoe; but the ſtale, or handle, riſes from the ſocket of the hoe, with a quick ogee ſweep; on the breaſt of which is placed a thin plate of iron, bent in ſuch a manner, as to diſpoſe the earth, raiſed by the hoe, on each ſide, towards the rows of plants.

One of theſe hoes is to be ſeen in the repoſitory of the Society of Arts, in the Adelphi, London. A plate of one is to be ſeen in the Bath Soc. Tranſ. Vol. III. page 263, to which I refer for farther particulars.

If, therefore, it be found by reiterated experiments, that Mr. Cooke's ſix-ſhared plough anſwers every purpoſe of drilling well, at nine, ten, or twelve inches diſtance in the rows; and at the ſame time, that this admirable invention of a ſix-ſhared hoe has ſucceeded to his wiſh; I think I may venture to ſay, that he ſeems to have put agriculture on the high road towards perfection.

But there is another mode of purſuing the drill huſbandry, which appears to have been tried with great ſucceſs, and has met with much approbation from thoſe who have ſeen and examined it. By ſome of thoſe gentlemen it has been called the half-huſbandry; but I think it would be much more proper to give it the name of the alternate-huſbandry, as it conſiſts in ſowing grain and pulſe in alternate rows, in the ſame field.

The firſt trial of this kind that I ever heard of, was made in this county in May 1781. The farmer had drilled ſpring-wheat in rows, two feet apart; he then ſowed turnips in the intervals, by hand. The turnips came up well, and were thinned with the hoe once. The wheat was a very good crop, and yielded better than another field of the ſame foil did, which was ſown broadcaſt in autumn; though it ripened ſomewhat later. In cutting it, the turnips were no otherwiſe injured, than by having ſome of the large leaves trodden down by the reapers. After harveſt, the weeds were cut up round the turnips, with a hand-hoe, after which they grew very large and vigorous. They were of the purple and white long kind, and the crop proved nearly as good as the ſame land produced in common.

The farmer carried them off the field in December, and, plowing in the ſtubble, left it in that ſtate till March, when he prepared it by two more plowings for barley and clover, of which he had a crop that yielded near forty buſhels per acre of the former, and the plant of clover was ſo good, that the cattle preferred its ſtraw to common hay.

The queſtion which naturally ſuggeſts itſelf on this occaſion is, whether the intervals ſowed with turnips in this experiment, would not have been as profitably employed in ſowing an intermediate row of wheat, by which means the rows would have been at one foot diſtance, and would have given good room for the hand-hoe, or Mr. Boote's ſix-ſhare hoe, which would have been ſtill leſs expenſive. Various modes, well executed, may certainly prove ſucceſsful: but it is by comparative trials only, that the advantages, or diſadvantages of thoſe modes can be aſcertained with propriety and preciſion. For my own part, I do not think the above-mentioned experiment anſwers any good purpoſe, or could be attended with any profit, either in the cleaning, pulverizing, or produce of the land: not but that the idea of alternate cropping, if properly executed, might be attended with ſucceſs: but, in order to attain this, the grain and pulſe, or roots, ſhould be confined to alternate rows, and ſuch ſpaces, or intervals left between each row, as to admit of the horſe-hoe, By theſe means, we have an exhauſting, and an ameliorating crop on the ſame land; and while part is loſing its fertility by the grain, the other is gaining by the tranſpiration, or exudation from the roots of the pulſe; and at the ſame time, the whole is improved by the cleaning, and pulverizing of the horſe-hoe. In order to accompliſh this moſt deſireable end, and bring it to perfection, the intervals between the grain and pulſe ſhould be kept wide; and the management of theſe cannot be better performed, than by that proceſs of horſe-hoeing, which I have deſcribed for wheat drill-ſowed at two feet and a half diſtance in the rows.

But, I confeſs, this mode of culture, which I have never tried, appears to me to be much better calculated for alternate rows of pulſe and roots, than for alternate rows of grain and pulſe; and that it is moſt applicable to lands which are in want of cleaning and pulverization, where it may probably be attended with great ſucceſs: but when lands are already clean, and in good tilth, I ſhould undoubtedly prefer cropping them with one grain, one pulſe, or one root; changing theſe annually, according to the ſtate of the land, and the various management it may require.

Reſpecting wheat, that king of grains, it is neceſſary I ſhould ſtill ſay ſomething of the newly introduced mode of ſetting it; on which I have already made ſome few obſervations, in the article of Sowing.

Where the ſoil is light and good, or where the land is well pulverized, I have no doubt of the ſucceſs of ſet-wheat, when the work is performed with ſkill and attention. This I take to have been the caſe in Norfolk, and Suffolk, where the practice has ſpread with rapidity; but on ſtiff, cold, wet lands, I can pronounce, from experience, that it will not ſucceed; for there the corn will not tiller, ſo as to produce an ample return.

The accounts given of it by the Norfolk farmers are, that after dibbling it into the land, generally on a clover lay, in the manner before deſcribed, it produces a larger crop, cleaner, better, and heavier corn, and affords employment to many poor women, and children, who may be employed upon it inſtead of men.

Trials of it were made in the years 1774 and 1775, in the following manner.

About Michaelmas 1774, a field of clover and rye-graſs ſtubble, containing twelve acres, was broken up, and plowed into broad ſtitches (diviſions by furrows), the land being ſound and dry. Theſe ſtitches were alternately ſet and ſown throughout the whole field, and the corn, after reaping, was laid up, and carefully kept ſeparate. On threſhing, it was found that the wheat which had been ſet produced two buſhels per acre more than that ſown.

About Michaelmas 1775, the like experiment was tried in a field of eight acres, which was a clean clover ſtubble, treated in all reſpects as the former. The reſult was, that the produce of the ſet-wheat exceeded that of the ſowed-wheat, one buſhel per acre.

In both trials, the corn of the ſet wheat was ſuperior to the ſown, in quality as well as in quantity. But, in order to ſtate the reſult in a proper point of view, I will give the following ſummary account of it.

Profit by ſeed ſaved on ſix acres, being nine buſhels, at five ſhillings per buſh.	£2	5	0
Ditto by increaſe of produce, ſix pecks per acre, at an average nine buſhels	2	5	0
	4	10	0
Expence of ſetting ſix acres, at eight ſhillings per acre	2	8	0
Neat profit	£2	2	0

Which profit is after the rate of ſeven ſhillings per acre. It ſhould alſo be obſerved, that the expence of ſetting is now greatly reduced, and I am informed, is done as low as five ſhillings per acre, which makes an addition of three ſhillings per acre to the above profit. But there are other advantages ariſing from this practice; one of which is, that the corn is not near ſo liable to be laid by heavy rains, and is of courſe more eaſily reaped. It has alſo this farther advantage on a clover lay, that, being ſet on the middle of the flag, or turf, and not running, like ſown corn, into the ſpaces between, it thereby avoids being mixed and diſturbed by the graſs, weeds, and trumpery, that generally riſe from between the flags, eſpecially if the land is not very clean.

The following particulars will more fully explain the nature and circumſtances of the above-mentioned crop. The ſoil was light, inclining to ſand, worth about fifteen ſhillings per acre; being within five miles of Norwich. The clover lay was only one year old. The holes were dibbled one inch deep, and two on a flag, near four inches apart. Two grains were intended to be ſet in each hole: but this is very uncertain, as it depends on the giddineſs of children, who will take no care. This crop was not hoed, though that would have been a great advantage to it. I do not find the produce per acre ſtated in the account. The ſtraw of the ſet-wheat was both higher and ſtouter than the other, and was more eaſily reaped. The Norfolk millers prefer this wheat, becauſe it is the moſt even ſample, with fewer ſmall corn intermixed; but it is nearly of the ſame ſize, and the flour is much on a par with that of the ſown wheat.

The kind of land on which ſetting ſucceeds beſt, has not been fully aſcertained. From my experience, I ſhould be inclined to think, that it would be done with moſt advantage on clover and rye-graſs lays, where the land is rather light and tender, and where the drill-plough cannot be commodiouſly uſed, on account of the apertures between the flags, and their irregularities. But where the land is ſo ſtiff and wet, that the ſeed cannot be readily covered by the buſh-harrow drawn over it for that purpoſe, I am ſure the corn would be better ſown broad-caſt.

This account is nearly in ſubſtance what I have found in the firſt volume of the Bath Society's Tranſactions; excepting where I thought it neceſſary to reconcile it more perfectly, by a few inconſiderable alterations, to my own experience, and practical knowledge. I ſhall now purſue this ſubject, by an extract from the ſame Tranſactions, to the following purport.

In October, the lands which have produced broad clover, or artificial graſſes, and ſometimes old paſture, the foregoing ſummer, are plowed up; taking care to lay the furrows as even as poſſible. A heavy roller is then paſſed over them, and a man, or ſeveral men, with a pair of inſtruments called dibbles, walk backward, making two rows of holes in the earth, or flag, ſo that the holes are three inches diſtant in the rows, and the rows on each flag, or line of turf, near five inches from each other. The dibbles are ſhort ſticks, with handles like a ſpade, and pointed in the form of a ſugar-loaf, with a croſs pin within one inch and a half of the point, to prevent the holes from being made too deep. One pair of dibbles employs four women, or children, who follow the dibbler, and drop two grains into each hole. After this a hurdle, prepared with buſhes, is drawn by a horſe acroſs the field, till the wheat is covered, and the holes are filled up. In this method, the ſeed is regularly placed in the ground, and four pecks are ſufficient for an acre; whereas ten pecks are the uſual broad-caſt allowance.

An experiment was lately made in Norfolk, and the following particulars laid before their agricultural ſociety.

A whole field was ſown and ſet in alternate ſtitches. They were cut, carried, and threſhed ſeparately. The produce of the ſet part was eight buſhels per acre more than the ſown, and thought to be ſixpence per buſhel better.

The writer of this account ſays, that he himſelf had ſet twenty-three acres, nine of which were old graſs land, ploughed then for the firſt time; ſeven acres were a lay of ſeven years old, and the remaining ſeven had been in graſs only two years.

The whole work, plowing, rolling, ſetting, and harrowing, was performed in ſeventeen days by three ploughs, having a pair of horſes and a man to each plough, five men dibbling, and twenty children dropping; the roll, and buſh-harrow employed another man. The land was as follows: the firſt, a black, mooriſh ſoil, and a clay under it: this, in Suffolk, is called a woodcock ſoil. The next ſeven acres (a hill), were on the top a ſtrong clay, and the lower part a mixed ſoil. The laſt ſeven acres, a light rich land. In Suffolk, they plough very ſtrong land with two horſes abreaſt; one man holds the plough, and guides the horſes with rope-reins.

For one acre in the Norfolk experiment:

Seed ſaved, five pecks, at ſix ſhillings per buſhel	£0	7	6
Superior produce, eight buſhels, at five ſhillings per buſhel	2	0	0
Superior value to that ſown, ſixpence per buſhel	0	4	0
	2	11	6
Expence of ſetting	0	10	6
Balance in favour of ſetting	£2	1	0

So that the farmer, by this method, gains the above balance, benefits ſociety nine buſhels and one peck, and feeds twenty-five extra-mouths.

I imagine that the reader will perceive the above calculation is erroneous: nor can it be rectified, unleſs we knew what was the exact produce of the acre of ſet-wheat; for it is ſixpence per buſhel upon the whole of that produce, that ought to be added in the above account, and not that upon the ſurplus of eight buſhels only. This will make the balance in favour of ſetting ſtill greater than in the above ſtatement.

On lands where wheat is ſet, the crop is free from thoſe ſhrivelled diminutive grains that are ſo commonly found, in even the beſt crops, that are ſown broad-caſt: of courſe it is ſpecifically heavier; and the proportion of flour exceeds the comparative difference of weight: it accordingly ſells at a price ſuperior to that of the beſt wheats ſown broad-caſt*.

Every farmer, of induſtry and activity, who adopts this mode, will find the performance eaſy beyond his firſt apprehenſion; and be fully repaid with an equal or greater quantity, intrinſically ſuperior to what ariſes from the common practice:

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* When wheat is very full of weeds, it is cuſtomary with neat farmers, to hoe it by hand, when either ſet or ſown; and they gain more by this, than the ſeven ſhillings and ſixpence per acre paid for the labour.

but, from the careleſſneſs of droppers, three pecks of ſeed ought to be allowed to an acre.

The next accurate and intereſting particulars I can give upon this ſubject, are contained in a letter from the Rev. Mr. Cloſe, to the Bath Society*. He there informs us, that the following experiments were made in two adjoining fields, only parted by a ditch, one containing ſix acres, and the other five. The ſix-acre field, after yielding two large crops of clover, was plowed October 18, 1782, and on that and the following day was ſet with wheat on the firſt earth, or, in other words, on the flag, allowing one buſhel of ſeed to each acre. In May following, the crop was properly cleaned by hand-hoeing. On the twelfth of Auguſt it was cut by twelve reapers. After ſtanding a proper time in the field, it was brought home, and, upon threſhing it, the ſix acres produced only eighty-four buſhels. October 16, and 17, 1782, the adjoining five-acre field was ſet in ridges, ſetting two feet, and leaving two feet intervals, with two pecks of ſeed-wheat per acre; that is, ten pecks on the whole field.

It was hand-hoed, and cleaned, in the ſame manner as the other crop, except that the intervals were horſe-hoed. It was reaped one day ſooner, ſtood in the field the ſame time, and was threſhed by the ſame labourers. The crop produced one hundred and twenty-eight buſhels and a half. This wheat ſucceeded a crop of potatoes, not manured for, but twice horſe-hoed. The tines of the ſetting, or dibbling frames, were three inches and a half apart.

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* Vol. III. p. 225.

Expences of the ſix-acre field.

Setting, at that time ten ſhillings per acre, but now done at ſix ſhillings	£3	0	0
Hand-hoeing, and weeding	3	0	0
Six buſhels of ſeed, at ſix ſhillings and three-pence	1	17	6
Rent of land	6	0	0
Tythe, one pound four ſhillings; town charges, fifteen ſhillings	1	19	0
Harrowing, to cover the ſeed	0	1	6
Reaping, and carting home	1	16	0
Threſhing, at eighteen pence per coomb*, becauſe the crop was mildewed	1	11	6
Carting three miles to market	0	10	6
Total expence	21	0	0
Received for eighty-four buſhels, at ſix ſhillings per buſhel	25	4	0
Neat profit from the ſix acres, only ..	4	4	0
Beſides ſtraw, worth two guineas	£2	2	0

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* A coomb is four buſhels, or half a quarter of corn.

Expences

Expences attending the five acres in the horſe-hoeing huſbandry.

Setting	£1	5	0
Hand-hoeing and weeding	1	5	0
Two buſhels and a half of ſeed	0	15	7½
Rent of land	5	0	0
Tythe twenty ſhillings; town charges twelve ſhillings and ſix-pence	1	12	6
Twice plowing	1	15	0
Harrowing before and after ſetting	0	2	6
Reaping, and carting home	1	5	0
Threſhing ſixteen quarters	1	12	0
Horſe-hoeing the intervals	0	9	0
Carting to market	0	16	0
Total expence	15	17	7½
Produce of ſixteen quarters, ſold at forty-eight ſhillings per quarter	38	11	0
Value of ſtraw	2	9	0
	41	0	0
Expences, as above	15	17	7½
Nett profit	£25	2	4½

Both theſe crops were damaged by the mildew; but the five-acre field leſs than the other. The ſix-acre field, however, had it received no ſuch injury, would never have yielded in any proportion

portion to the other; as it produced in the ſtraw only ſix fair driving waggon loads; whereas, from the five-acre field, there were ſeven large loads, though only half the land was ſet, the reſt being in alleys, or intervals.

Mr. Cloſe, in a ſubſequent paper, adds, that after the above experiment, there had been two more crops taken from the five-acre field; and that in 1784 it produced ſix quarters per acre. That in October, 1785, the burthen in ſtraw was not equal to the former year; but that the ears were remarkably long and large, ſome of them meaſuring eight inches, and many containing ſeventy grains of corn: ſo that he eſtimated the crop, though not then threſhed, at ſix quarters per acre. This, ſays he, will make the return from the three years crops, on the five acres, without any aſſiſtance from manure, amount to one hundred and ten pounds eleven ſhillings, or, thirty-ſix pounds ſeventeen ſhillings each year: a produce far exceeding his moſt ſanguine expectations.

The ſame gentleman, in a letter to the Society in London, gives an account of a crop of wheat ſet with intervals of two feet two inches, planted with potatoes between the rows, both of which produced ſo abundantly, that he reaped from ſix acres and a half thus cultivated, eighty-two pounds in one year. The wheat was ſet the 18th of October, 1783. The champion potatoes were planted the 26th of April, 1784. The wheat was reaped the 29th of Auguſt, and the potatoes were taken up in October. Wheat thirty-two coombs; potatoes one hundred and forty-eight ſacks*.

There is ſtill another mode propoſed for the culture of wheat; which is, by ſowing it with a drill-plough, ſo conſtructed, as to drop it in cluſters of ſix or ſeven grains, at three, four, or five inches diſtance in the rows. This was even put in practice, with great ſucceſs, by the Reverend Mr. Lowther, who correſponded with the London Society upon the ſubject, and promiſed to ſend them a cluſter ſowing-plough, of his own invention, but was prevented by death†.

An ingenious friend of mine, who is always watching for opportunities to do good, has been eager to promote a plan for the tranſplanting of wheat, by taking the plants from the ſeed-bed, and dibbling them out into the field, like cabbage plants. This ſpecies of culture would, no doubt, promote extremely the branching, or tillering of the plants, and thus greatly increaſe the produce of the land. That it would anſwer well on a ſmall ſcale, hardly admits of any doubt; that it would anſwer on a very large one, admits of many*.

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* Lond. Soc. Tranſ. Vol. IV. p. 6.

† Lond. Soc. Tranſ. Vol. II. p. 23.

I ſhall conclude this ſection, by giving a ſeries of four years experiments, on alternate crops of drilled wheat and beans, made by Mr. Arbuthnot; whoſe judgment, veracity, and preciſion, entitle him to the moſt ample confidence.

Culture of Drilled Beans, 1767.

The ſoil of this field is a ſtrong dark-coloured loam, tending to clay, on a clay bottom. In 1766, it yielded wheat, the ſtubble of which was very foul, with numerous weeds. It was plowed once in the ſpring; and on that earth dibbled with beans, part tick, and part horſe-beans: of the firſt, two buſhels and a half per acre; of the latter, two buſhels. The rows were equally diſtant, ſixteen inches aſunder. They were hand-hoed twice; the crops, three quarters and a half per acre.

Expences per acre.

One plowing	£0	10	0
Seed	0	8	0
Dibbling	0	6	0
Two hand-hoeings	0	12	0
Carry over	£1	16	0

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* Robert Bogle, Eſq; of Dikdewie, in Scotland. Bath Soc. Tranſ. Vol. II. p. 157.

Brought over	£1	16	0
Reaping	0	7	0
Harveſting	0	5	0
Threſhing three quarters and a half	0	4	6
Carrying ditto out	0	5	0
Rent, &c. &c.	1	2	0
	£3	19	6

Produce.

Three quarters and a half (nine gallons to a buſhel) at twenty-ſix ſhillings	£4	11	0
Straw	1	10	0
	6	1	0
Expences	3	19	6
Clear profit per acre	£2	1	6

This profit on a crop that muſt be conſidered as a ſubſtitute for a fallow, is very conſiderable; and ſhews that drilled beans, even on a ſingle plowing, may be advantageouſly employed in cleaning foul land.

Expence and Culture of a Crop of Drilled Wheat.

The bean ſtubble of the preceding experiment was plowed directly after harveſt, throwing down the lands. The field was then plowed with little Suffolk ſwing-ploughs. Five of them did eight acres in a day; after which it was ridged up again;

again: the ridges two-bout lands, three feet and a half over. They were harrowed once, and drilled two rows of wheat on each, at ten inches aſunder: the quantity of ſeed, three pecks per acre. After the drilling, the furrows were ſtruck with the double mould-board plough, and the land left well water-furrowed. In the ſpring, ten ſacks per acre of malt-duſt were ſown on the corn; the ten-inch partition was once horſe-hoed with the ſhim, and the intervals five times with the ſame inſtrument, being followed each time with the double mould-board plough. The laſt horſe-hoeing was after the bloſſoming of the corn, the horſes being muzzled: the rows were once hand-hoed with five-inch hoes. The product, four quarters per acre.

Expences.

1768. Firſt plowing	£0	8	6
Second ditto	0	4	6
Third ditto	0	4	6
Harrowing	0	0	6
Three pecks of ſeed	0	5	0
Drilling	0	1	6
Striking furrows	0	1	2
Water furrowing	0	1	0
Ten ſacks of malt-duſt, at two ſhillings and eight pence	1	6	8
Carry over	£2	13	4

Brought over	£2	13	4
Shim, ſix times	0	4	0
Double mould-board plough	0	5	10
Reaping	0	8	0
Harveſting	0	3	0
Threſhing, and binding the ſtraw	0	13	6
Carrying out	0	2	0
Rent, &c. &c.	1	2	0
	5	11	8
One hand-hoeing (omitted above)	0	4	0
Total	£5	15	8

Produce.

Four quarters, at fifty-two ſhillings and ſixpence	£10	10	0
One load and a half of ſtraw	1	10	0
	12	0	0
Expences	5	15	8
Clear profit per acre	£6	4	4

This profit on a drilled crop of wheat is much in favour of this ſpecies of culture; particularly if we take into account the fine order into which the land muſt be brought by the hoeing, &c. being no leſs than thirteen operations. A broadcaſt crop may equal this in point of profit, but can never leave the land in ſuch a ſtate of perfection,

fection. It ſhould be remarked, that this mode leaves intervals of two feet eight inches from double to double row, and that the ten inch partition was horſe-hoed with a ſmall ſhare put on the ſhim.—I wiſh it had been explained in what manner the plants were ſaved from the horſe's tread.

Culture and Expence of Drilled Beans, 1769.

The wheat ſtubble of the laſt experiment was plowed up in the beginning of December; the ridges on which the wheat grew, were reverſed: they were then drilled with beans, double rows on each, at fourteen inches diſtance; conſequently the intervals were two feet four inches. The ſeed two buſhels an acre. Five acres were the mazagan ſort, and three the tick. The culture beſtowed on them while growing, conſiſted of two hand-hoeings, and ſix horſe-hoeings; three with the ſhim, and as many with the double mould-board plough. The product was three quarters per acre.

Account of the Mazagan.

1769. Plowing	£0	4	6
Harrowing	0	0	6
Drilling	0	1	6
Seed	0	10	0
Striking furrows	0	1	2
Carry over	£0	17	8

Water-

Brought over	£0	17	8
Water-furrowing	0	1	0
Two hand-hoeings	0	10	0
Shim thrice	0	2	0
Double mould-board, ditto	0	3	6
Reaping	0	8	0
Harveſting	0	3	0
Threſhing three quarters, at one ſhilling and two pence	0	3	6
Rent, &c. &c.	1	2	0
	£3	10	8

Produce.

Three quarters of beans, at forty ſhillings	6	0	0
Straw	0	10	0
	6	10	0
Expences	3	10	8
Profit	£2	19	4

Account of the Ticks.

Expences.

As above, except ſeed	£3	0	8
Seed, two buſhels at three ſhillings and ſixpence	0	7	0
	£3	7	8

Produce.

Three quarters, at twenty-eight ſhillings	£4	4	0
Straw......................................	1	0	0
	5	4	0
Expences	3	7	8
Profit	£1	16	4

The difference of profit between the two ſorts of beans is great, and ſhews how much depends on chooſing ſeed with judgment. Mr. Arbuthnot has remarked, that the great advantage of the mazagan bean is, its being harveſted a month before the tick, and ſix weeks before the common horſe-bean; which is a circumſtance very much in its favour: and if a perſon chooſes to ſow turnips among his beans, in the manner I have mentioned, they are covered by the laſt hoeing; and by the beans coming off early, they give more air to the turnip plants. The meat of this bean is both whiter and fuller than that of any other ſort.

Culture, Expence, and Produce of Drilled Wheat, 1770.

In the ſame field, the bean ridges were plowed down directly after harveſt, and then croſs-plowed; upon which earth it was ox-harrowed, that is, with the great harrows. Next, it was ridged up again into three feet and a half lands, and harrowed with one horſe. This is done by the horſe walking in the furrow, drawing two ſmall harrows, each covering half a land. In October, it was drilled with wheat, four rows on each land, eight inches aſunder, with one buſhel per acre: after which the furrows were ſtruck as uſual with a double mould-board plough, and the field water-furrowed.

The 14th of November, one land was manured with rabbit's dung; at the rate of eighteen ſacks per acre, at one ſhilling and two pence per ſack. Another land with poultry dung, at the rate of ſeventy-two buſhels per acre, at ſixpence: and a third with wood aſhes, the ſame quantity, at four pence. The poultry dung turned out much the beſt; the rabbit next; and the aſhes laſt.

In March, all the reſt of the field was manured with twenty ſacks an acre of rabbit dung. It was hand-weeded once between the rows, and ſhimmed twice in the intervals of one foot ſix inches, and once with the double mould-board. The product three quarters per acre.

Expences.

Firſt plowing (land very dry)..........	£0	12	0
Second ditto..........................	0	10	0
Harrowing twice.......................	0	3	0
Carry over	£1	5	0

Ridging

Brought over	£1	5	0
Ridging up	0	4	6
Harrowing	0	3	0
Drilling	0	1	6
Seed	0	6	0
Striking furrows	0	1	2
Water-furrowing	0	1	0
Twenty ſacks of rabbit dung, at one ſhilling and two pence	1	3	4
Hand-hoeing	0	4	0
Shim	0	1	4
Double mould-board	0	1	2
Reaping	0	8	6
Harveſting	0	5	0
Threſhing	0	9	0
Carrying out	0	1	6
Rent, &c.	1	2	0
	£5	15	3

Produce.

Three quarters, at fifty ſhillings	£7	10	0
One load and a half of ſtraw, at twenty-five ſhillings	1	17	6
	9	7	6
Expences	5	15	3
Profit	£3	12	3

Here ends a courſe of four years drilling on the ſame land: it includes therefore all the common circumſtances that generally affect crops, whether favourable, or unfavourable. The land was in foul order, no other fallow was given to it than drilled crops; that material end was anſwered, and the produce at the ſame time profitable. I cannot, however, but remark, that conſidering the culture, and manure beſtowed on this land, it might have been naturally expected, that the crops of the third and fourth years would have turned out much greater than they actually did; and it would have been a ſatisfaction to have heard what reaſons Mr. Arbuthnot could aſſign, for their not being more productive.

One fact however, of great importance, is deducible from this courſe of drilled crops; viz. that beans and wheat may be raiſed alternately on the ſame land, for any number of years, without its getting foul, or requiring a fallow.

Another fact here aſcertained is, that the annual profit per acre on theſe crops, though they are no way extraordinary, amounts to three pounds twelve ſhillings and two pence.

I muſt alſo obſerve, that in ſome future experiments made by Mr. Arbuthnot, on the culture of the Magazan bean, he found that thoſe drilled in November were more productive than thoſe drilled in February, by four buſhels per acre.

Although the above profit per acre is ſurely very handſome, yet Mr. Arbuthnot was of opinion, that more could be gained by the following courſe of crops: 1, cabbages; 2, Windſor beans; 3, oats; 4, clover; 5, wheat. One advantage from this courſe ariſes from the quantity of dung produced by the cattle fed on the cabbages and clover.

Mr. Arbuthnot is of opinion, that a little manure given to land frequently, is infinitely more beneficial, than a great quantity laid on once in five or ſix years. Of the truth of this obſervation, I am perfectly convinced from experience.

Bean ſtraw for work-horſes is as good as middling hay.

SECTION II.

Of SPRING WHEAT.

SPRING, or, as ſome call it, Summer-wheat, is ſowed the earlieſt of all the grains, commonly diſtinguiſhed by the appellation of Spring, or Lent-corn; ſo named, from the ſeaſon in which they are ſown. As the grain of this is ſmaller than that of the other ſort, and it yields a leſs abundant crop, farmers never chooſe to ſow it, except, by any accident, they loſe the proper ſeaſon of ſowing their winter wheat. Their culture is alike in all reſpects, and they ripen at the ſame time. From the latter end of February to the middle of March, and ſometimes a little later, is the uſual ſeaſon for this ſpring-ſowing.

Sir William Fordyce gives the following account of a crop of Siberian ſpring-wheat, ſown by him at Hyacinth-hill, Wandſworth-common.

The land was firſt turned up from common, in 1764, (being at that time full of alternate clay, and gravel-pits, or covered with thorn, and furze) after which time, it was alternately under crops of wheat, turnips, clover, oats, or tares, till July 1774, when a crop of tares was cut off from it, and made into hay. After a good coat of compoſt made in the farm-yard, of loam, fern, horſe and cow-dung was laid on it, he plowed for turnips, which were ſown by the 20th of Auguſt, and they were taken off the ground at five guineas per acre, by the cow-keepers of Southwark, about the middle of March 1775.

Between the 25th of March and the 4th of April, he ſowed two buſhels of the Siberian wheat per acre, on four or five-bout ridges, laying it down with red clover, Dutch ditto, and rye-graſs ſeeds, in the uſual quantities. As it was only then threſhing out, he could not ſpeak of the quantity but by the tythe, which makes it two quarters per acre: it was reaped with a ſickle on the 7th, and 8th of Auguſt. On the 20th of September, it ſhewed as fine a crop of red clover in flower, as ever was ſeen, and was mowed for clover hay; yielding, by the computation of his gardener and labourers, one ton and an half per acre, beſides ten days cut-clover for three cart-horſes, from five acres. When the wheat ſtood in the ear, the furrows were not diſtinguiſhable from the ridges; ſo full were they of wheat, and ſo much was the ſurface upon a level.

As fodder is often ſcarce in many parts of England, particularly in the neighbourhood of London, and other great towns, even where manure is plentiful, perhaps this would be a grain to lay down graſs-ſeeds with, preferable either to oats, barley, or other ſpring-corn; as, in good ground, and favourable ſeaſon, it would at leaſt help young ſtock through the winter, beſides furniſhing a crop of good clover, to feed working horſes, in the autumnal feed time.

I ſhall here add another account of ſpring-wheat and barley, from Mr. Whitmore, to

O. S. Brereton,

O. S. Brereton, Eſq; Vice-Preſident of the Society of Arts, &c. in London. The ſoil on which he began to uſe the drill-plough was a good hazel loam, a ſpade's depth, with a ſandy, gravelly bottom. In the year 1783 it brought him a good crop of turnips, after proper preparations of fallowing, mucking, &c. Theſe were eat off the premiſes laſt ſpring, when it was twice plowed, and was in the middle of April ſowed with Cooke's drill-plough, at eighteen inches interval, ſix ſtatute acres of barley, and two of ſpring wheat, taking ſomething leſs than a buſhel of wheat to each acre: as ſoon as the grain was completely up, and weeds, eſpecially charlock, began to appear, he had the crop well hoed by two men working Cooke's hoe, doing with eaſe two acres a day. This was repeated on a ſecond appearance of weeds, which made the crop very vigorous, ſo that the intervals were hardly viſible. While ſtrong crops in the neighbourhood were lodged with heavy rain, his roſe again with great vigour. His return was upwards of ſixty buſhels of barley, and thirty buſhels of ſpring wheat to an acre; whereas the richeſt ſpots of land there, will not produce above fifty buſhels of barley, beſides the great ſaving of ſeed, which is an object of the utmoſt importance.

The two hoeings were well performed for three ſhillings per acre. He had therefore great reaſon to recommend the drill for autumn ſowing, and had been informed that many crops, by this method, had turned out forty and fifty buſhels, but obſerves that they were drilled in rows at one foot diſtance.

Spring wheat has this advantage, in countries where the winters are very ſevere, that it is not ſubject to blight: for which reaſon it might be very prudent to ſow of both kinds in ſuch climates.

It cannot, however, be expected, that theſe late ſowings ſhould produce plants quite ſo vigorous as thoſe which remain four or five months longer in the earth, or that they ſhould tiller equally: but their crops will be very good, if rightly managed, as we have juſt ſeen from Mr. Whitmore's account.

The ſoil ſhould be ſomewhat drier for wheat ſown in the ſpring, than for the ſame ſort of grain ſown in autumn; and it will ſtill be better, if it be ſomewhat richer.

Wheat is the beſt and wholſomeſt of all grains, and the moſt generally uſed in England for bread. It yields a very ſtrong ſpirit; and if malted, which is illegal, and mixed in ſmall quantity with other malt, it would add greatly to the ſtrength of beer, as well as to its keeping, but makes it taſte more luſcious. A little wheat bran boiled in our ordinary beer will make it mantle in the cup, when poured out; which ſhews with what a rich ſpirit this grain is indued, ſince ſo much remains in the bran.

SECTION III.

Of SPELT.

SPELT, though commonly reckoned a ſummer-corn, is ſowed either in autumn, or in the ſpring, at the ſame time as wheat or rye. This grain, of which there are two ſorts, one with a ſingle, and the other with a double chaff, though both have always two ſeeds in each huſk, was formerly much eſteemed in Italy and Egypt, and is now very common in Germany, where they make bread of it, which is both nouriſhing and well-taſted, but hard to digeſt. They likewiſe brew beer from it in ſome places. It was of this grain that the ancients made their frumenty, of which they were very fond.

Though commonly ranked as a ſpecies of wheat, which it is not unlike when growing, its grain is ſmaller, and of a blackiſh hue, its ſtalk thinner, and leſs firm, and its ear flat and bearded, with ſeeds only on each ſide. Some writers diſtinguiſh a third ſort by the name of white rye, which they take to be the *olyra* of the Greeks and Latins, and ſeems to be what Mr. Mortimer calls *Tritico-ſpeltum*, a ſort of naked barley, or wheat-barley, cultivated in Staffordſhire, ſhaped like barley, but with a grain like wheat. It is much ſown at Rowley, Hemſtal, and Redmore, where they call it French barley. It makes good bread, and good malt, and yields a good increaſe; and therefore would do well to be tried in other places. It ripens early, does beſt in a dry ſoil, and is not apt to be much hurt by birds; from which its beard and double huſk preſerve it.

SECTION IV.

Of BARLEY.

MR. MILLER diſtinguiſhes four ſpecies of barley, viz. 1, Spring barley, with many rows of grain: 2, The common long-eared barley; 3, Barley wtth ſhorter and broader ſpikes, commonly called ſprat-barley; and 4, Winter, or ſquare barley, which is alſo called bear-barley, or big.

The firſt of theſe, which is the common ſpring barley moſt generally cultivated in England, is again divided into two ſorts, viz. the common, and the rath-ripe barley; which laſt our author takes to be only an alteration in the former, occaſioned by its having been long cultivated upon light gravelly ground: and, in fact, the ſeeds of this early ſort will, when taken from ſuch a ſoil, and ſown in ſtrong, ſtiff land, ripen near a fortnight ſooner than others of the ſame kind taken from ſtrong land. For this reaſon, the farmers in the vales generally purchaſe their ſeed barley from the light gravelly uplands; but after two or three years culture in the vales, it becomes as late of ripening, as the barley which is the uſual produce of the place: ſuch are the effects of habits in plants. On the other hand, the farmers in the uplands procure their ſeed-barley from the ſtiff grounds in the vales; for without this change, the grain would degenerate in fulneſs and in bulk. This ſort of barley is eaſily diſtinguiſhed by its double row of beards, or awns, which ſtand erect, and by the thinneſs of its chaff.

The common long-eared barley, which is Mr. Miller's ſecond ſort, is an excellent grain, and much cultivated in many parts of England, though ſome farmers object to it, becauſe, ſay they, the length and weight of its ears render it the moſt liable to be lodged. The grains of this ſort regularly ranged in a double row, lie over each other, like tiles on a houſe, or the ſcales of a fiſh, and are without awns.

The ſprat-barley, likewiſe called Fulham barley, from the great quantities of it cultivated about that place, has ſhorter and broader ears, and longer awns, which help greatly to preſerve it from birds, and cloſer ſet grains than any of the other ſorts, which it ſeldom equals in height; nor is its ſtraw, being coarſe as well as ſhort, accounted ſo good fodder for cattle.

The bear-barley, or big, is ſeldom cultivated in the ſouthern parts of England, but very much in the northern counties, and in Scotland, becauſe it is by far the hardieſt of this ſpecies of corn. There are two ſorts of it; one with four rows of grains, commonly called four-rowed barley, and the other with ſix, which is diſtinguiſhed by the name of barley-big. The rind of this is thicker than that of the other ſorts; for which reaſon our maltſters hold it leaſt in eſteem.

Both the four-rowed and the ſix-rowed barley are generally ſown in the autumn, nearly at the ſame time as wheat, not only in temperate climates, but alſo in very cold countries; their hardineſs being ſuch, as to bear the winter's froſt, even in the mountainous parts of northern regions. In hot countries, they are ſown in January, February, and March.

Though barley, like every other grain, would ſucceed beſt in a rich and well-tilled ſoil, yet it is found to do very well in light and ſandy, as well as in poor ſtiff lands, which would not be able to nouriſh wheat: but it delights particularly in light dry ground, ſuch as the black rich mould, and in moſt ſorts of clays, which lie dry; eſpecially if theſe laſt have been well manured with dung, aſhes, chalk, or lime. Sir Hugh Platt commends ſoap-aſhes as an extraordinary improver of this grain, even upon barren land; and it has been experienced, that pigeon's dung, malt duſt, and ſoot, are remarkably efficacious here.

The common time for ſowing barley in this country is, early in March for very dry light land, but in ſtrong clayey ſoils it is not ſown till April, and ſometimes not till the beginning, nay even the end of May, which is certainly too late; becauſe, if the ſeaſon does not prove extremely favorable, the autumn muſt be far advanced before the crop can be fit to mow; unleſs it be of the rath-ripe ſort, which frequently ripens in nine weeks from the time of ſowing. But Mr. Liſle is of opinion*, that this ſort in particular ſhould be ſown early, otherwiſe it will grow very thin. He thinks alſo it ſhould be ſown on better ground than other barley, becauſe, as it ripens in a ſhorter time, it may be ſuppoſed to exhauſt the nutritive juices of the earth faſter than other corn. In anſwer to this it is ſaid, that theſe nutritive juices, in almoſt any ſoil, will hold out long enough to feed a crop of ſuch ſhort ſtanding as this is, though they might not ſuffice for corn which ſhould remain longer upon the ground; and that near Patney, in Wiltſhire, where a great deal of this grain is raiſed, it is ſown on the pooreſt ſandy ground, and thrives perfectly well. What ſeems to be leſs diſputed is, that this ſpecies of corn ſhould not be ſown in a ſtrong ſoil; becauſe its ſtraw being very hollow and weak, it will be liable to be beaten down, and lodged.

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* Vol. I. p. 273 and 278.

Where this ſpecies of barley cannot readily be procured, it might perhaps anſwer as well for the huſbandman, on account of the lateneſs of the ſeaſon, to take a crop of buck-wheat, if the ſoil be any how ſuitable.

The land which lies both dry and healthy, and in which mellowneſs and lightneſs are joined to ſtrength of ſoil, is that which produces the beſt bodied and thinneſt rinded barley; qualities which always recommend this grain, particularly to

maltſters.

maltſters. Such generally is the barley of the growth of hilly countries. It is however allowed, that poor land, which lies dry and warm, will bear better corn of this kind, than rich land in a wet and cold ſituation: for barley does not ſo much ſtand in need of ſtrength of land, as of healthineſs and warmth of ſoil; though both are beſt, where they can be had.

To the general directions before given, for the choice of ſeed corn, I ſhall only add, with reſpect to barley, that the beſt grain for ſowing, is that which is not blackiſh at the tail, nor has a deep redneſs, but is of a pale, lively, yellow colour, intermixed with a bright whitiſhneſs; and if the rind be a little ſhrivelled, it will be ſo much the better; for that ſlight ſhrivelling, occaſioned by its having ſweated in the mow, is a ſure indication that its coat is thin. The huſk of thick-rinded barley, being too ſtiff to ſhrink, will lie ſmooth and hollow, even when the inſide flour has ſhrunk from it.

The neceſſity of a change of ſeed from time to time, by ſowing that of the growth of a different ſoil, is no where more evident than in the culture of this grain, which otherwiſe becomes coarſer and coarſer every year.

Barley is much benefited, as well as wheat, by being ſteeped before it is ſown: and ſurely this muſt be of great advantage to every ſort of ſpring corn, as rain cannot be depended on ſoon after the ſowing of them, ſo much as after the autumnal ſowings.

Mr. Chapple, in a letter to the Bath Society*, recommends this practice from experience. He there informs them, that he ſoaked his ſeed-barley in the black water taken from a reſervoir, which received the drainings of his dung-heap and ſtables. As the light corn floated at top, he ſkimmed it off, and let the reſt ſtand twenty-four hours. When taken from this water, he mixed the ſeed-grain with a ſufficient quantity of ſifted wood-aſhes, to make it ſpread regularly, and ſowed three fields with it. He began ſowing the 16th, and finiſhed the 23d of April. The produce was ſixty buſhels per acre of good clean barley, without any ſmall or green corn, or weeds, at harveſt. No perſon in his neighbourhood had better grain.

Mr. Chapple went farther, and tried other fields with the ſame ſeed ſown dry, and unprepared, but the crop, like many in his neighbourhood, was very poor; not more than twenty buſhels per acre, and much mixed with green corn and weeds, when harveſted. He likewiſe ſowed ſome of the dry ſeed on one ridge in each of the former fields, and there alſo the produce was very poor, when compared to the other parts of the field.

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* Bath Soc. Tranſ. Vol. III. p. 326.

Here then are three experiments, the truth and accuracy of which we have no reaſon to doubt, and which amount to demonſtration in favour of the practice of ſteeping, and drying with wood-aſhes. Let me only add, that if there were one half foot mixed with the aſhes, it would be a very great improvement, for the reaſons I have formerly aſſigned.

I would by no means recommend the liming of barley; it is of too hot a quality to be ventured on in a dry ſeaſon of the year.

The Rev. Dr. Elliot relates* of a farmer who ſowed oats at break of day, and harrowed them in before ſun-riſing; that the corn thus early ſowed, outſtript the other oats ſown on the ſame day after the ſun was up, had larger ears, and appeared every way better, though the ſpot in which it grew was the worſt part of the field. It is reaſonable to think that dew, which brings along with it from the air much mucilage, and other fertilizing particles, ſhould have great effect when buried with the ſeed; and perhaps it might anſwer the purpoſe full as well, to ſow the grain in the evening, allow it to receive all the dew of the night, and harrow it in the next morning.

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[*] Eſſays on Field-Huſbandry, p. 29.

The courſes of crops are now extremely varied, according to the nature of the ſoil, and the ſtate of the culture in which it may be. Barley is often the firſt crop after turnips, and clover-ſeed is generally ſown with it, or rather a fortnight, or three weeks after it, that it may run no riſk of being checked, or overpowered by that ſucculent plant: it is thus ſucceeded by the crop of clover, and then wheat is ſown on the clover lay.

Sometimes barley is firſt ſown after a good fallow; 2, clover fed all ſummer; 3, wheat; 4, vetches, or tares fed off, and then the land is again plowed, and brought into good order for barley. This is a good courſe of crops on poor lands, and will anſwer well.

What I reckon a good fallow for barley is, when the land has been plowed three times at leaſt. At the firſt plowing it ſhould be laid up in ſmall ridges, or bouts, ſo as to remain all the winter expoſed to the froſt. Another plowing ſhould be given the beginning of February; in March, ſplit the ridges, and lay the land flat; at the ſame time harrowing it fine: But in ſtrong wet lands (if you have no other for barley) lay it round, and make deep furrows to receive the water.

Mr. Mortimer relates*, that a farmer in Eſſex, who lived near a market-town, from whence he had good quantities of dung, uſed to ſow his land with barley and clover, reaped the corn at harveſt, fed the clover all the winter, and from ſpring to the middle of July, when he fallowed his ground. In the next ſpring, he ſowed it again with barley and clover, and repeated every year this method, by which he had large crops. His land was a light rich mould, ſomewhat inclining to a gravelly bottom. This would not do on poor light land.

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* Vol. I. p. 532.

In Norfolk, they ſow their lighteſt lands in April, and their moiſt lands in May: finding that thoſe lands which are moſt ſubject to weeds, produce the beſt crops when ſown late.

Their common method is to ſow the barley-ſeed broad caſt at two ſowings; the firſt harrowed in once; the ſecond twice; the uſual allowance, from three to four buſhels per acre. But if farmers could be prevailed on to alter this practice, they would ſoon find their account in it. Were only half the quantity ſown equally, the produce would be greater, and the corn leſs liable to lodge: for when corn ſtands very cloſe, the ſtalks are drawn up weak, and on that account are leſs capable of reſiſting the force of winds, or of ſupporting themſelves under heavy rains.

From the great ſucceſs of ſetting and drilling wheat in Norfolk, ſome of the farmers there tried theſe methods with barley; but did not find them anſwer their expectations, except on very rich land.

*The gentleman farmer, who communicates this information to the Bath Society, ſays at the ſame time, that by this method he had had eighty ſtalks on one root of barley, which all produced good and long ears, and the grain was better than any other; and yet, he adds, "but this method is too expenſive for general practice."

When ſo much ſeed-barley is ſaved, when the plants tiller ſo amazingly, as to produce eighty ſtalks, with good long ears filled with better grain than any other, I was not a little ſurprized to ſee the concluſion drawn from ſuch premiſes; a concluſion, which I am ſure they do not warrant.

The next opinion, from the ſame writer, is more ſenſible, and better founded; when he ſays, "In poor land ſow thin, or your crop will be worth little." Farmers who do not reaſon on the matter, will be of a different opinion; but the fact is indiſputable.

The Bath correſpondent, proceeds to ſay, "When the barley is ſown, and harrowed in, the

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* Bath Soc. Tranſ. Vol. II. p. 96.

land ſhould be rolled after the firſt ſhower of rain, to break the clods, and lay the ſurface ſmooth for ſowing. This will cloſe the earth about the roots, which will be a great advantage to it in dry weather. When the barley has been up three weeks, or a month, it is a very good way to roll it again with a very heavy roller, which will prevent the ſun and air from penetrating the ground, to the injury of the roots. This rolling, before it branches out, will alſo cauſe it to tiller with a great number of ſtalks; ſo that if the plants be thin, the ground will thereby be filled, and the ſtalks ſtrengthened.

"If the blade grows too rank, as it ſometimes will, in a warm wet ſpring, mowing is a much better method, than feeding it down with ſheep, becauſe the ſcythe takes off only the rank tops; but the ſheep being fond of the ſweet end of the ſtalk next the root, will often bite ſo cloſe, as to injure its future growth.

"By attending to what is here recommended, (continues the Bath correſpondent) many of our farmers uſually get forty buſhels of barley per acre, from land of no very extraordinary quality. On ſome that is rich, he has had fifty-two buſhels, without manure: but he never ſowed more than ten, and often only eight pecks of ſeed per acre."

And here I muſt beg leave to obſerve, that I agree heartily with the above writer, in condemning the practice of feeding barley with ſheep; yet I muſt confeſs, that unleſs it was very rank, and very forward indeed, I ſhould alſo mow it with much reluctance; perſuaded as I am, that much of the health and nouriſhment of all plants depends upon a luxuriant foliation.

I have already obſerved, that this gentleman appears to me to have decided very haſtily, and even raſhly, againſt the drill-ſowing of barley. I ſhall be vindicated in this reflection, when I refer my reader to what has been ſtated by Mr. Boote, as the produce of a crop thus ſowed after turnips, upon what he calls a light ſand; which produce amounts, by his account, to ſeventy-two buſhels, four gallons, and one pint, and exceeds that of the above gentleman by twenty buſhels, four gallons, and one pint.

In confirmation of this ſucceſsful experiment by Mr. Boote, we have another communicated by Sir John Anſtruther, Bart. to the Bath Society*, wherein the produce of an acre ſown broad-caſt, and one drill-ſown, is compared. Sir John there ſays, that they were ſown on the ſame field, at the ſame time, and there was no apparent difference in the ſoil. The rows were drilled at eighteen inches diſtance, and the grain dropt by hand; the expence of which was three ſhillings and threepence per acre. The ſeed thus drilled was one buſhel and three gallons per acre. The produce was fifty-ſix buſhels and three gallons per acre.

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* Vol. III. p. 389.

The quantity ſown broad-caſt was three buſhels and five gallons per acre. The produce only thirty-ſix buſhels and five gallons per acre; being a difference of about twenty buſhels per acre in favour of the drill-huſbandry, which, joined to the former example, certainly leaves no room to doubt of the great ſuperiority of this method; eſpecially when we add to this the ſaving of ſeed, and great advantage of keeping the ground clean, and in good order for a ſucceeding crop.

The Siberian barley, which is earlier than ours, by about a fortnight, might be uſeful where the farmer is obliged to ſow late, as is often the caſe in Norfolk, after a crop of turnips. It might in ſuch caſes anſwer all the purpoſes of the rath-ripe kind, without having its defects. I do not find, however, that thoſe who have tried it, have diſcovered in it any other ſuperior quality to recommend it. It is neither more productive, nor is it heavier, than the common kinds in uſe here*. I ſhall, however, give the following account of an experiment made by the Norfolk Agricultural

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* Bath Soc. Tranſ. Vol. I. p. 112.

Society, noted in the ſaid Tranſactions, Vol. I. p. 150.

The ground choſen for this purpoſe was a ſandy loam: in the ſummer of 1773 it bore oats, and in autumn, the ſame year, had three plowings; in the ſpring of 1774 it was plowed three times more. Being then in good order, it was divided into two parts. No. I. contained three rods, two perches, and nine ſquare yards. This was ſown or ſet with Siberian barley, by dibbling, from the 9th to the 13th of May 1774. The diſtance of the holes was about ſix inches one way, and four the other. Two grains were to be dropt in each hole, which took one buſhel and a handful. On the 18th of June the ſtalk was two feet high, and the ear completely formed in the ſheath. The ſummer proved wet, and the rain beat it down. It was cut the 6th of September; ſome of it grew before it was carried home, and ſome could not be threſhed out of the ſtraw; but the produce was forty buſhels, one peck, Wincheſter meaſure, each buſhel weighing fifty-four pounds. No. II. (the other part of the field) contained one acre, four perches, and ten ſquare yards. This was ſown under furrow with Siberian barley on the 10th and 11th of May 1774; by which means this part had one plowing more than the other. The ſeed ſown was four buſhels. This was ſooner and more beaten down with the rain than the other, as it grew thicker; but as it was cut ſooner, Auguſt 26, it was not ſo much damaged, the other having began to grow before it was cut. This produced forty-nine buſhels, Wincheſter meaſure, each buſhel weighing fifty-four pounds. Bread was made of this barley, 1, with half barley, half wheat; 2, with two-thirds barley, and one-third wheat. The laſt was thought to make a ſweet and pleaſant bread.

Broad-caſt, May 10 and 11, four buſhels of ſeed. Cut Auguſt 26. Produce forty-nine buſhels, each weighing fifty-four pounds.

Dibbled, May 9 to 13, one buſhel of ſeed. Cut September 6. Produce, forty-nine buſhels, each weighing fifty-four pounds.

Barley is ripe when the red roan, as farmers call it, meaning a reddiſh colour, is gone off from the ear, when it bends down its head, and when the ſtraw has loſt its verdure. It ſhould not be cut till then: for the grain of ſome ears which ſtand upright may ſeem to be full, hard and dry; yet the ſtraw, if carefully examined, eſpecially at the knots, will ſtill be found to be greeniſh, and will therefore be apt to heat in the mow, which will render the grain abſolutely unfit for malting, or indeed almoſt for any other uſe; for it then becomes ſo very bitter, that even hogs will hardly eat it. If it be full of weeds, it muſt lie in ſwarth till they are dry, which may be the more eaſily done, as this corn is not apt to ſhed; but, on the other hand, it will incline to ſprout, or grow muſty, in wet weather; for which reaſon it ſhould be ſhook up, and turned every fair day, after rain; and as ſoon as it grows dry, it may be made up into cocks; though it muſt not be houſed whilſt any moiſture remains in it.

Mr. Liſle ſays, that poor thin barley, and oats, ſhould be cut a little ſooner than if the ſame plants were ſtrong and vigorous; for that the ſtraw, when they are full ripe, will not ſtand againſt the ſcythe. In this caſe, the barley, in particular, muſt lie in ſwarth, till it is thoroughly dry. Some of his, which lay out in ſwarth five or ſix days, though both blighted and edge-grown, grew plump, and acquired very near as good a colour as the beſt. He reckons ſhort ſcythes the beſt for mowing lodged or crumpled corn, becauſe they miſs the feweſt plants; and obſerves, that a bow upon the ſcythe, which will carry the ſwarth away before it altogether, is preferable to a cradle, the fingers of which would be pulled to pieces by the entangled corn, in drawing back the ſcythe. I have, however, notwithſtanding this obſervation of Mr. Liſle's, always made uſe of the cradled ſcythe, which I think a clever implement, and have never found any ſuch inconvenience attending it. One perſon is accounted ſufficient to rake oats after the cart, unleſs in a very high wind; but to rake after the barley cart, be the wind ever ſo ſtill, two perſons are always reckoned neceſſary: and it is likewiſe thought to be good huſbandry, becauſe it ſaves much time, to have two pitchers to one loader in the field, when the ſtraw of the barley runs very ſhort.

The huſbandman ſhould be very attentive to the proper culture of this grain; ſince from it is made the moſt ſocial cup of any thing that this country affords, and perhaps as wholeſome as is produced in any other. The common ſpring, and the common long-ear'd barley, are the ſorts moſt generally eſteemed here for malting, becauſe their rind is thinneſt. The ſquare-eared barley, diſtinguiſhed by the name of big, is very little uſed or valued, by our maltſters, on account of the thickneſs of its hull; but the Scots, from experience, think it equal to any other kind for malting; and in Flanders, where a great deal of beer is drank, they chiefly uſe malt made of this ſort of grain.

In many countries, where their wheat falls ſhort, they make bread of barley, either alone, or mixed with wheat. This bread is cooling, and pretty nouriſhing; but hard to digeſt, and taſteleſs.

Barley has its medicinal virtues, and is often uſed in cooling and pectoral drinks. The Scots make uſe of it in their ſoups or broths, in which it makes an excellent ingredient. We ſend a great deal of it into Holland, where they manufacture it into what is called pearl barley, or French barley, for theſe are nearly the ſame; and what is aſtoniſhing, we have never yet been able to bring that manufacture to great perfection in this country.

In Spain, where little beer is drank, they feed their horſes with barley: we often give it to poultry: but for both theſe purpoſes, it is very much miſapplied; as oats, which are cheaper, are infinitely more hearty and ſtrengthening food. Horſes, nay even men, who uſe bread made of oats, will do more and harder work upon that, than upon white bread; and fowls will fatten better, with whiter and firmer fleſh, and will lay ſooner, than when fed with barley. Mr. Mortimer reckons barley one of the beſt grains for fatting of ſwine; either when boiled till it be ready to burſt, with no more water than it drinks up, or ground in a mill and made into a maſh. In either way, it will produce good bacon: but, reaſoning from anology, without experience, I ſhould be apt to imagine, that oats and oatmeal would have a quicker and perhaps a better effect.

Mr. Arbuthnot whoſe experiments on the articles of wheat and beans I have already quoted, has alſo favoured us with ſome comparative trials of broad-caſt and drilled barley, and gives a deciſion in favour of the former. I ſhould truſt much to the ſkill and approved judgment of that gentleman, in every thing relating to huſbandry, if I did not ſee before my eyes ſuch contradictory information, and that I likewiſe obſerve in all his crops of barley, whether from the one kind of culture or the other, the produce has been ſo vaſtly inferior to that of others, ten and twelve buſhels, two and two and a half quarters, and ſo on, that I muſt attribute the failure to ſome accidental cauſe, which with me greatly invalidates the weight of his experiments in this important article.

I have indeed made the ſame remark on Mr. Arbuthnot's experiments on wheat and beans, where I could not help expreſſing my ſurprize at the ſmallneſs of the products from land in ſuch high condition, ſo expenſively manured, and ſo ſkilfully cultivated.

The ſame deficiency is apparent in his culture of peas. What this is owing to, I am quite at a loſs to determine, unleſs it aroſe from a too great mixture of new ſoil; but could have wiſhed much to have heard his own conjectures about it, which muſt have been ſenſible and ſatisfactory.

Mr. Arbuthnot concludes from his trials, that barley muſt be excluded from the liſt of drill crops; unleſs in very narrow intervals, which will juſt admit the hand hoe: but it muſt be obſerved, that ſince theſe trials were made by Mr. Arbuthnot, both drilling and hoeing are much better underſtood, and the implements with which they are performed, greatly improved. I am therefore confident that barley, as well as wheat, may be drill-ſown, with great ſucceſs, and that being depoſited in the ground at an equal depth, it will be much leſs liable to ſhoot and to ripen unequally, than in the broad-caſt way; to which defect, broad-caſt barley is extremely ſubject in dry ſeaſons.

In ſupport of this opinion, I will here give an account of an experiment by Dr. Hunter, as related by him in his Georgical Eſſays. In the ſpring of the year 1769, he ſowed an acre of barley in equi-diſtant rows, with the drill plough, in a field that was ſown with the ſame grain and on the ſame day, broad-caſt. This laſt took three buſhels per acre; the drill required only ſix pecks. The drills were eight inches aſunder, and the ſeed was lodged about two inches deep. The drilled acre was finiſhed within the hour, and not a ſingle grain could be ſeen on the ſurface.

In the courſe of growing, the drilled barley ſeemed greener, and bore a broader leaf than the broad-caſt. When the ears were formed throughout the field, the ear of the drilled barley was plainly diſtinguiſhed to be near half an inch longer than the broad-caſt, and the grains ſeemed fuller and better fed. This occaſioned a general ſurpriſe, and the Doctor himſelf was at a loſs to account for the apparent difference.

Reflecting, however, upon ſome experiments he had made upon the roots of wheat, he was induced to dig up ſome roots of the drilled and of the broad-caſt barley, and was agreeably ſurpriſed to find the cauſe of the difference to proceed from their roots. The pipe of communication between the ſeminal and coronal roots of the drilled barley, was conſiderably longer than that of the broadcaſt. And upon that circumſtance he was convinced that the length of the ear, and ſtrength of the ſtraw, principally depended.

The product of two hundred ſquare yards of the broad-caſt and of the drilled barley were carefully houſed, and afterwards threſhed out. The drilled exceeded the other nearly a fifth in meaſure, and being a bolder and better grain, weighed heavier, at the rate of two pounds in the buſhel.

SECTION V.

Of OATS.

MR. MILLER reckons four ſorts of oats cultivated in England; viz. the white, the black, the brown or red, and the naked oat: in which, though ſuppoſed to be only accidental varieties, he has never obſerved any alteration, where they have been cultivated ſeparately for many years. Their principal difference is in the colour of their grain.

The white ſort, which is moſt common about London, affords the whiteſt meal, and is chiefly cultivated where the inhabitants live much upon oat cakes. The black is alſo very generally cultivated for feeding horſes. Red oats are much grown in Derbyſhire, Staffordſhire and Cheſhire, but are ſeldom ſeen in any of the counties near London; though, as they are a very hardy ſort, and yield a good increaſe, they would be well worth cultivating, eſpecially in ſtrong lands. The ſtraw of theſe oats is of a browniſh red colour, as is alſo the grain, which is very full and heavy, and is eſteemed better food for horſes, than either of the other ſorts. The naked oat is leaſt common in the ſouthern parts of England: but in the northern counties, in Scotland, and in Wales, it is pretty much cultivated, and is particularly eſteemed, becauſe its grain threſhes clean out of the huſk, and need not be carried to the mill to be made into oatmeal.

As oats are very hardy, and thrive in almoſt any ſoil, they have been a great improvement to many eſtates in the parts of this kingdom, where, though ſown ſo late as April, and in ſtiff ground, they have ripened early, and yielded a good crop. However, February or March, according as the ſeaſon proves early or late, is a more common time for ſowing this corn; of which it will always be right to ſow the largeſt grained ſort earlieſt.

Oats are often ſown after a crop of wheat, rye, or barley; in which practice the common method is, to turn in the ſtubble, with one plowing, about the beginning of February, and ſow the ſeed with a broad-caſt, at twice, harrowing it in, once after the firſt ſowing, and five or ſix times after the ſecond; obſerving to draw the harrow once or twice acroſs the furrows, to break the clods and cover the ſeeds; but at the other times to harrow in the ſame direction as the furrows, leſt the ſtubble ſhould be raiſed on the ſurface. But it would be much better huſbandry, to plow in the ſtubble in autumn, that it may rot in winter, and then to give the land another plowing, and a good harrowing, juſt before the oats are ſown. This will render the ground much finer and fitter to receive the grain, the increaſed produce of which will amply repay the extraordinary expence of tillage.

But the way to have the beſt crops of all ſorts of grain is, as I have before mentioned, to ſow them after an ameliorating crop. The returns would then be much more plentiful, than in the common way, becauſe the land would be in a much looſer ſtate, and every way better prepared.

When oats are ſown upon a lay, or on ground newly broken up, after one plowing only, which is given in January, when the earth is moiſt, to turn down the ſwerd, the harrowing muſt be in the ſame direction as the furrows, or but very little acroſs, for fear of raiſing the turf.

But this again is bad huſbandry: for the ground would be brought to a much better tilth for other grain, as a preparation for which this ſowing is chiefly intended, by giving the ſwerd time to rot before the oats are ſown; becauſe the roots of the graſs will prevent thoſe of the corn from ſtriking downward.

But much the beſt way of plowing a lay for ſuch a crop is, with Mr. Ducket's trenching plough, which I have before deſcribed. See Plate III. This implement will give a proper depth of ſoil over the ſwerd, for the roots of the new crop.

Black oats delight in a moiſter ſoil than the white ſort, and, being a hardier plant, may be ſown a month earlier. The white prefer a dry ſoil, and will do well on ſand and gravel, are the beſt of all corn for ground ſubject to quich-graſs or weeds, becauſe it may be plowed later for them, and they riſe ſooner, and top the weeds better than the black oats. The weather can hardly be too dry when white oats are ſown; and Mr. Liſle adds to this remark, that, according to his obſervation, white oats require a rich feeding ſoil, becauſe their haulm, or ſtraw, running to great ſize, cannot be ſupported without good juices and moiſture; that white chalky ground, though in ever ſo good heart, will be unfruitful with white oats; and that a mixed mould, between white earth and red clay, of which there is a great deal in the hilly parts of Hampſhire, is not feeding enough for them. The red and white clays, when in good heart, carry moiſture enough, and are very fit for this grain.

It is very common to allow four buſhels of ſeed oats to an acre: but three buſhels are more than enough. For my own part, I would never ſow more than two buſhels and a half, whatever be the ſtate of the land : for if it be rich and in good tilth, the plants will tiller and bring a good crop ; if it be poor and in bad condition, it is unable to nouriſh a plentiful crop : and thus in both ways mediocrity is beſt. The average produce of oats is about twenty-five buſhels per acre ; but it ſhould be obſerved, that, in general, there is leſs preparation made for oats, than for any other crop. Were the land dreſſed and tilled for oats, as it uſually is for wheat or barley, it would be no uncommon thing to reap from five to ſeven, nay even eight quarters per acre. Mr. Ellis* mentions a farmer near Leighton, in Bedfordſhire, who, by means of good culture and dreſſing, uſed frequently to reap crops of nine quarters of white oats per acre, off very poor light ſoil.

It is moſt common to ſow clover with a crop of barley, and in general this anſwers well : but I am of Mr. Ellis's opinion, in preferring the practiſe of ſowing clover ſeed with a crop of oats, if the ground be in good heart ; becauſe the ſtalks of oats are ſtiffer than thoſe of barley, are leſs apt to be lodged, and conſequently the clover is leſs liable to be ſpoiled.

When oats are about three or four inches high, it is then a good time to ſow the clover ſeed, after

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[*] Ellis's Huſbandry, Vol. I. p. 338.

a ſhower of rain: they ſhould be well buſh-harrowed both ways of the field, and rolled. This ſtirring of the earth and breaking of the clods after the rain, will give freſh vigour to the oats, and make them tiller more conſiderably: it alſo lays the ground ſmooth for the ſcythe*. Both oats and barley ſhould be carefully weeded.

Mr. Ellis's direction for ſowing oats is, to ſow them half on the rough earth as the plough left it, after which the ground being once harrowed, the other half is to be ſown and harrowed in long ways and croſs ways, till the ſeed is well covered.

My method is always to harrow once before ſowing, in order to ſmooth the land; then to ſow and harrow acroſs, to ſow again and harrow twice over the furrow.

Farmers in general account an ordinary crop of white oats, as good as a full crop of black ones. This laſt ſort is alſo moſt liable to blight, eſpecially if a hot ſummer follow a dry cold ſpring, and the grain has been ſown on lay ground. Their culture is alike: and the manner of mowing and managing them at harveſt, the ſame. It is only to be obſerved, that white oats are apt to ſhed moſt as they lie, and black oats as they ſtand.

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* In the ſame manner, as here directed for clover, other graſs ſeeds may be ſown, in order to lay down land, and has been found to anſwer well; but as oats are an exhauſting grain, it would be right to dreſs the land well in the autumn or following ſpring.

This method has been known to produce two tons per acre at one cutting. See Bath Soc. Tranſ. Vol. I. p. 158.

Oats are ripe when the ſtraw turns yellow, the grain becomes hard, and the chaff begins to open and ſhew the ſeed. When mowed, they are generally let lie ſome time for the dew and rain to plump them, and make them threſh well, and, if weedy, to kill the weeds: but if rain wet them much, they ſhould be carried off as ſoon as they can be got tolerably dry again, or they will ſhed; for oats may be inned the wetteſt of any corn, if the weeds among them be ſufficiently withered. Even in very rainy harveſts, when other grain is ſpoiled, this will receive little or no damage; the ſurface of its ſtraw and ears being ſo ſmooth and compact, as to turn off water; and of ſo dry a nature, that, though houſed wet, they will not heat in the mow, or become mouldy, as other grains uſually do. This is a vaſt advantage in northern climates, where the harveſt is generally late, and the autumn wet.

Mr. Liſle ridicules the idea of oats cut green ripening in the ſwarth: he ſays, they may ſhrink, dry, or wither, but can never increaſe or ſwell, as if vegetation was ſtill going forward. Having been obliged to cut ſome oats green, mixed with others that were more early, he let them lie in ſwarth above a week; and when carted, he found the huſk of the greeniſh oat had got a riper colour, and the pith was well hardened, but pitifully lean, and ſhrunk*.

The meal of oats makes good bread for theſe who have been accuſtomed to it from their infancy. It was formerly much in uſe for this purpoſe over moſt parts of this country, but has been getting gradually into diſuſe for many years; ſo that white bread prevails now almoſt over the whole iſland, even among the loweſt claſſes of people: though I cannot help being of opinion, that they have abandoned a food upon which they could have ſupported more labour and fatigue.

In ſome places, beer is made of this grain; in Ruſſia, in particular, the poorer ſort make with it a drink they call Quas: but its principal uſe is for the food of horſes, for which purpoſe it is reckoned very wholeſome, being ſweet and of an opening nature; but it ſhould not be given them, till it has been ſweated in the mow, or otherwiſe dried, leſt it prove too laxative.

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* It is very poſſible to cut oats too green for them ever to ripen, though a certain degree of vegetation ſurely goes on after reaping; and the ſap in the ſtalk continues its former courſe till exhauſted. This is what ſerves to plump wheat, and other grain, when cut unripe. This is what makes fallen trees ſend forth freſh ſhoots; and a ſimilar cauſe makes the hair and nails, &c. of animals, grow after death.

The very long drought of the ſummer of the year 1762, was the cauſe of ſhewing another very profitable uſe of oats. Some cow-keepers, near London, boiled oat-meal in the water which they gave their cows to drink, and found that the expence was abundantly repaid by the additional quantity of milk which theſe cows yielded more than thoſe which had not this maſh.

SECTION VI.

Of MAIZE, or Indian Corn.

MAIZE is ſo generally uſed for food in America, that it has obtained the name of Indian Corn. The ſize of its ear differs greatly, according to the fertility of the ſoil, and the warmth of the climate, in which it is cultivated; but at a medium, it is about a ſpan long; and commonly has eight, or more, rows of grain, each of which uſually contains upwards of thirty ſeeds, of various colours, as red, white, yellow, blue, olive, greeniſh, blackiſh, ſpeckled, ſtriped, &c. ſometimes in the ſame field, and even in the ſame ear; but the white and yellow are the moſt common: nor does this diverſity of colour ever reach beyond the outſide of the grain, the flour of which is always white, with a yellowiſh tinge. Theſe ſeeds, which are as big as large peas, are round at their outer ſurface, very ſmooth, and ſet extremely cloſe in ſtraight lines. The ear is cloathed and armed with ſeveral ſtrong thick huſks, which defend it, not only from unſeaſonable rains, and the cold of the night (for in ſome places it does not ripen till the end of September), but alſo from crows, and other birds, which, being allured by the ſweetneſs of the grain before it hardens, flock to it in great numbers, peck through the outer covering, and devour it as far as they can reach.

In the northern parts of America, the ſtalk of this plant, which contains a very ſweet pith, and is jointed like a cane, does not grow near ſo high as in the ſouthern parts. It has long leaves, almoſt like flags, at every joint, and at the top a bunch of flowers of various colours, highly pleaſing to the eye.

Mr. Miller is of opinion, that there are three diſtinct ſpecies of this plant, which do not alter by culture, viz.

1, With yellow grains, which grows naturally in the iſlands of the Weſt-Indies, and has a very large ſtrong ſtalk, which riſes to the height of ten or twelve feet.

2, With white grains, is cultivated in Italy, Spain, and Portugal. The ſtalks of this ſpecies are more ſlender than thoſe of the former, and ſeldom riſe higher than ſix or ſeven feet.

3, With a yellow and white ſpike, is cultivated in the northern parts of America, and alſo in Germany. The ſtalks of this are ſlender, and ſeldom riſe more than four feet high. Its leaves are ſhorter, and narrower, than thoſe of the two former, are hollowed like the keel of a boat, and their tops hang down. The ſpikes of the male flowers of this ſort are ſhorter than thoſe of the others, and the ears or ſpikes of grain are ſeldom more than four or five inches long. This ſort ripens perfectly well in England, and in as ſhort time as barley; and therefore may be cultivated here to advantage, and might probably turn to good account for many purpoſes. Great quantities of it are raiſed in Aſia and Africa, in ſeveral parts of France, in Italy, Germany, and North-America.

The following is the account of its culture by the Engliſh in America:

They plow the ground thoroughly before the grain is planted. They ſeldom dung the whole face of the field, but ſometimes put a little dung in each hill of corn, if they think the ground requires it. When fiſh are plentiful in the ſeaſon of planting, they put two or three ſmall fiſh into each hill, with the grain.

In order to plant the corn, they make trenches, or furrows, with the plough, acroſs the field, at certain diſtances from each other, and croſs theſe with others of the ſame diſtance, which checquer the field, or divide it into ſquares; and where the furrows interſect, the grain is ſet, and covered. Three or four grains are commonly put into each hill. The intermediate ground is afterwards plowed at leiſure, as the plants grow, and want more looſe earth for the roots to ſpread in. The hills are made at the time of weeding, ſome looſe earth being then hoed up over the roots, and round the ſtems, or ſtalks of the corn. The diſtance from center to center of the hills, each way, is about three or four feet; and the hills are enlarged at every weeding, by laying up freſh mould to the roots of the plants. The mornings and evenings, when the dew is off, are reckoned beſt for this work.

Inſtead of hilling the plants as they grow up, ſome people prefer planting them in holes; as they require a great deal of moiſture for their nouriſhment: and indeed nature ſeems to have provided for that, by the form and poſition of the leaves, which ſerve to convey the moiſture to the ſtalks, and from thence to the roots. It might therefore be a better way, not to form the hills complete, but to leave a baſon, or hole round the ſtalks, as a receptacle for the rain.

The panicles or toſſils contain the *farina fæcundans* of the plant, and therefore ſhould not be cut off till the grain in the ear is filled. Were theſe cut off over the whole field, there would be no grain in the ears. This has been proved by experiment.

The eaſieſt way of taking the grain out of the ears, is by holding one in each hand, and rubbing them againſt each other.

When the ears are ſtript of their huſks, they are in the beſt ſtate for preſervation; much better than when the grain is rubbed off from the ear, for inſects can then get at the ſoft parts of the grain, which they cannot do while it is connected with the cob in the ear, and the hard part of the grains are outward, and cloſe to each other.

To preſerve this corn, they make a ſort of binns, or cages, with ſpars of wood, roughly framed, and ſo diſtant from bar to bar, as to admit air without letting the ears fall out. They are fifteen or ſixteen feet long, and five or ſix feet wide, growing a foot or more wider at top. Theſe binns ſtand abroad, and are thatched over ſlightly, to keep off the rain.

The manner of uſing this corn in America is various. It has this advantage over wheat, that ſubſiſtence may be drawn from your corn-fields long before the general harveſt; for the green ears, roaſted, are delicate food; and as the corn ripens, and grows harder, the ears boiled are good eating, with butter and ſalt. When it is ripe, the corn parched, and ground into meal, is the hunting and war proviſion of the Indians; being light to carry, and affording good nouriſhment. They mix a little of it with water, and it needs no other cooking; having already paſſed the fire in the parching. The grain ſoaked in water will part with its ſkin when beat in a large mortar with a wooden peſtle: then it is boiled, and eaten with milk. Being dry, and pounded coarſely, it is boiled, and eaten as rice. Bag puddings, and baked puddings, when well made of it, are very good. The meal is alſo boiled with water, to make what they call a haſty pudding, which they eat with butter and ſugar, or with milk. This haſty pudding, or boiled meal, being mixed with twice as much dry wheat flour, and worked into loaves, makes much better, and more palatable bread, than flour alone. All creatures fed with Indian corn, have firm and fat fleſh: the pork of Indian-corn-fed hogs, is reckoned the fineſt in the world for taſte and goodneſs; their fat is milk-white, and as hard as butter. The horſes of Virginia and Maryland, whoſe chief fodder is the leaves and ſtalks of this corn, are reckoned the hardieſt of the ſpecies, bearing moſt labour and requiring leaſt care: and the people of thoſe countries where it is the common food of man, are healthy, hardy, and ſtrong.

The Engliſh Americans have alſo found out a way to make good beer, either with bread made of this corn, or by malting it. This laſt proceſs is ſomewhat difficult, on account of the great ſprouting of the grain at both ends; but to make beer with the bread of maize, they only break, or cut it into lumps, about the bigneſs of a man's fiſt, maſh it, and then proceed as with malt; treating the impregnated liquor in the ſame manner as wort, with, or without the addition of hops, as is beſt liked. The beer thus made, is ſaid to be well coloured, wholeſome, pleaſant, and will keep well.

This corn is thought to keep better than wheat, and has frequently been of infinite ſervice in many countries in times of ſcarcity. Many of the peaſants of Guyenne lived upon maize for years, without finding any inconvenience from it. The common way of uſing it there for bread is, to mix about an eighth part of it with ſeven parts of wheat, or wheat and rye, to which it gives a ſavoury taſte. Bread made of the flour of maize alone, is heavy and hard to digeſt, becauſe its dough ferments very little.

It anſwers all the purpoſes of the white pea, about the ſize of which its grains are, and would certainly be a better ſubſtitute for the poor, than bean flour, or ſome other ſorts, which have been uſed, even in England; where maize may doubtleſs be cultivated in light ſandy lands, where peas and beans do not thrive well. It is excellent for feeding of poultry, either given whole to the larger ſort of fowls, or broken a little for the ſmaller. The Breſcians, in Lombardy, who are remarkable for the fatneſs of their capons, uſe a great deal of it for this purpoſe. The Indians reckon it a remedy in all acute diſorders: and it has been obſerved, that thoſe people are very little ſubject to the ſtone; which ſome aſcribe to their living upon this corn. They extract from its ſtalk when green, a ſweet ſyrup, which anſwers all the ends of ſugar; and when the ſtems are diveſted of their ears, and dried, they make excellent fences, and thatch for ſheds, &c.

The Indians and Engliſh Americans, where the ground was good, or well manured with fiſh, have planted with the maize in every corn-hill, a kind of kidney-beans, which run up the ſtem of the corn, and are ſupported by it: others plant potatoes, gourds or pumpkins, and others ſow turnips, in the intermediate ſpaces between the hills.

Mr. Miller recommends the horſe-hoeing huſbandry, as in all reſpects fitteſt for the culture of maize; and gives the following as the method, which has been attended with the greateſt ſucceſs.

The land, which was very light and ſandy, and far from being rich, was plowed deep before winter, and laid up in high ridges till the ſpring, when it was broken fine with the harrow. It was plowed again in April, laid level, harrowed ſmooth, and then ſowed in drills, four feet aſunder. The ſeeds were dropped in the rows, at the diſtance of eight or nine inches from each other. When the plants were about three inches high, they were thinned with a hand hoe, by cutting up ſome of them; and the intervals between the rows were plowed ſhallow, to deſtroy the young weeds: but when the ſtems were advanced, the intervals were plowed deep, and the earth laid up to the plants on both ſides; and when the weeds began to grow again, a third plowing was given, to deſtroy them. This kept the ground pretty clean of weeds, till the corn was ripe, as the ſeaſon did not not prove wet; for otherwiſe a fourth plowing would have been neceſſary. Each of the ſtalks of theſe plants produced from three to ſix ſpikes of grain.

I have no doubt but this method of Mr. Miller's would anſwer very well: but for my own part, I would prefer the ſetting in ſquares or checkers, as practiſed in America; both becauſe the plants on the hills can be kept cleaner, and better ſupplied with freſh mould, and alſo becauſe it gives a better opportunity of croſs plowing the field, of clearing it of weeds, and bringing it into a fine tilth; ſo that by theſe means you are giving a complete ſummer fallow, and are reaping at the ſame time a profitable crop. This is the perfection of huſbandry.

Sir Richard Bulkley, who planted ſome of this corn in Ireland, had from each grain, which grew a foot aſunder in rows three feet apart, from three to ſix ſtems, and on each ſtem three ſpikes or ears, with two hundred and forty grains in each ear: this is an amazing increaſe, and worthy the attention of thoſe, whoſe ſoil would anſwer for the culture of this grain.

In France, they ſet this grain in May; but with us I do not think it ſhould ever be later than the middle of April. Towards the middle of June they hand-hoe round each plant, and about the end of July they hand-hoe again, laying up the mould round the plants.

The panicles of the male flowers, which grow at the top of each plant, and are well known not to contain any grain, are cut off about the middle of Auguſt. But care muſt be taken, that the grain be impregnated before they are cut off; which may be known, by the then turgid appearance of the outward covering of the ears: nor ſhould the panicles be cut off from all the plants at the ſame time; becauſe ſome of the ears are not impregnated till a fortnight after others. Theſe panicles are excellent food for cattle. When they are cut, or ſhortly after, all the leaves are ſtripped off the ſtalks, together with all the blighted and ſmutty ears; for it is ſaid, that the good ears would not grow ſo large, nor the grain be ſo well nouriſhed, if they ſhould be left upon the ſtalks: this to me however ſeems very doubtful, from what has already been obſerved on the vegetation of wheat and other plants. All the leaves and ears thus ſtripped off, are given as fodder to oxen; and it is remarkable, that thoſe creatures are fonder of the ſmutty ears, than of all the reſt.

The time for reaping maize is about the end of September: but if ſowed in the beginning of April, it may be fit to reap in the beginning of September. The ears are then gathered by hand, and put into baſkets, in which they are carried and laid in heaps, from ſpace, to ſpace in the field; after which they are carried home in carts, and ſpread upon a floor prepared for the purpoſe. They are then taken out of their ſheath, or hood, and dried in the ſun, before they are laid up in the granary; or elſe the grain is taken out at that time. Maize which has been well dried will keep ſeveral years, and not be the leſs fit for ſowing. The granary ſhould be very dry; and the corn laid up in it ſhould be turned at leaſt every three months, to prevent its growing muſty, or being attacked by inſects.

There are two ways of taking out the grain. The moſt expeditious is by threſhing it, with a flail; but in this method, a great deal of the corn is broken or bruiſed. The moſt common way is, by rubbing the ears hard againſt the edge of a flat piece of iron. This eaſily ſeparates the grains from the ſpike, or cob, without hurting them; and the remainder of the ear is very good food for oxen.

As ſoon as the ears are gathered, the ſtalks are pulled up and laid by for a winter fodder for oxen. The field is afterwards plowed up as ſoon as poſſible: it being the general opinion of farmers, that the roots of the maize would otherwiſe continue to ſuck up the rich particles of the earth. This, however, is a mere vulgar prejudice: for whatever they ſuck in, they moſt certainly reſtore to the land, when it is plowed and they rot.

Maize is ſometimes ſowed broad-caſt for fodder, and harrowed in: but in this way it impoveriſhes ſo much, that it requires both much labour and manure, before the land is again made fit for wheat.

It ought to be obſerved, that the ears of maize are greatly hurt by cutting the panicles too late; and that they ought to be cut before the hoods are open. By leaving a plant with its male flowers at every twenty feet diſtance, all the female ears will be impregnated.

SECTION VII.

Of MILLET.

THIS plant, which grows naturally in India, from whence it was firſt tranſported into Europe, is greatly cultivated in Italy, Spain, and the ſouthern parts of France, for the food of men, as well as for that of poultry: and we alſo raiſe it in ſeveral places in England; though we have our annual ſupply of this grain from the Eaſt

Indies; which makes ſome people call it, erroneouſly, Eaſt-India wheat.

It delights in a light ſandy ſoil, prepared in the ſame manner as for maize, and in ſuch land it branches out into many ſtalks, ſometimes thirty or forty, not unlike reeds, either in their ſhape, or leaves, of which there is one at each joint. The top of each ſtalk is terminated by a large looſe panicle, which hangs on one ſide, with a chaffy flower, which is ſucceeded by a ſmall round ſeed, about the bigneſs of turnip or cabbage ſeed, of a yellowiſh white colour in one ſort, and of a dark red, inclining to black, in another. The ſmall millet, and the large, a diſtinction which ſome writers make, are only varieties of the ſame ſort. It is likewiſe ſaid to thrive extremely well on ſtrong land; but will not do in ſtony ground, or where the bottom is either chalk or clay.

Mr. Miller directs ſowing this grain in the beginning of April, which is ſurely very proper in this country, that it may be ripe in Auguſt; but in warmer climates, the general rule is to ſow it, either between the middle and end of May, or at Midſummer. The former is reaped at the end of September, and the latter about the end of October.

The ſeed is ſowed in furrows, very thin, and covered with the ſhort-tined harrow or rake.

The largeſt ſort ſhould be ſowed thinneſt, becauſe it branches moſt. When the plants are about a month old, the ground ſhould be ſtirred round them with a hand hoe; as well to lay freſh earth to their roots (for they require a great deal of nouriſhment), as to clear them from weeds, of which they will afterwards prevent any great increaſe, by over-topping them. At the ſame time, the millet ſhould be thinned wherever it grows too cloſe, ſo as to leave, in general, about ſix inches between each plant. The huſbandman has nothing more to do to this grain till harveſt, excepting that, when it begins to ripen, he muſt take great care to protect it from birds, which would otherwiſe ſoon devour it. If preſerved from them, the returns are very great: for it is not eaſily hurt by drought or rain, nor is it ſubject to blight. Frequent ſhowers of rain are of great ſervice to it, while growing.

When the millet is ripe, its panicles are cut off near the uppermoſt joint of the ſtalk, with a knife, and put into baſkets or ſacks, in which they are carried home. They are then laid up in heaps, covered over with cloths, and after remaining in that ſituation five or ſix days, are ſpread upon the barn floor, threſhed out with a flail, and cleaned, like other grain. Great care muſt be taken to dry it well in the ſun, before it is laid up in the granary: for it would ſoon ſpoil, if the leaſt moiſture were left in it; this being of all grains the moſt difficult to keep, unleſs it be thoroughly dry: and, on the other hand, none keeps longer, or better, after it has been well dried. It is not ſubject to the weevil; and though it ſhould be turned from time to time in the granary, yet if that happens now and then to be neglected, it ſtill keeps perfectly well.

It has always been obſerved, that the late-ſown millet, I mean ſo late as Midſummer, had the greateſt number of abortive grains, that its panicles are ſmaller than thoſe of the ſame grain ſown earlier, and that the crop is leſs plentiful.

The ſmall white millet, which is by far the moſt delicate, and of which puddings, &c. are made, is the ſort chiefly cultivated in this country. The red, which is much larger, and coarſer, and which might be cultivated here, perhaps, to greater advantage than the other, is only uſed occaſionally for pigeons, poultry, and ſwine, for which laſt it ſhould be ground to meal: but the peaſants about Bourdeaux, where a great deal of it is raiſed in the poor light lands near that city, make of it a reddiſh, heavy, ill-taſted bread, difficult to digeſt. The culture of this ſort, which is Mr. Miller's *ſorgum**, is in all reſpects the ſame as that of the white; only, as it grows much larger, the plants require more room.

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* Gardener's Dictionary, Article *Holcus.*

Millet, either when green, or after its grain is threſhed out, is very good fodder for cattle; for which uſe it may be ſowed thicker, than for a crop of grain. Its many roots, large ſize, and quick growth, are ſaid to render it a great impoveriſher of the land: for which reaſon, ſome people pull up the roots, and plow the ground immediately, as ſoon as the crop is reaped: but it is infinitely more judicious to plow in the ſtubble and roots, which rot and enrich the ſoil: beſides, I am perfectly convinced that this, like all other ſucculent plants, ſo far from being robbers, are real enrichers of the ſoil; giving to the earth, by exudation of their roots, not only what they borrow from thence, but alſo what, by their leaves, they abſorb from the atmoſphere.

From what has been here ſaid of this plant, it is eaſy to perceive, that it would ſucceed beſt by the means of the horſe-hoeing huſbandry, which would both give room for its roots to penetrate in ſearch of food, and by moulding up the ſtalks, would give them freſh ſtrength and vigour. It is an excellent crop for plowing into land, as a green dreſſing; for, as it abounds in foliage, it furniſhes a large proviſion of mucilagenous matter; and as its ſtalks are ſtrong, they help greatly to keep the ſoil hollow till they putrify.

SECTION VIII.

Of BUCK WHEAT.

THIS plant, though a very uſeful one for various purpoſes, has been greatly neglected in England, till of late years, when it began to be better known, and more cultivated.

This grain has been much more in uſe in France, from whence we improperly give it the name of French wheat: and we call it alſo, by corruption, buck wheat, whereas its real Engliſh name is beech wheat, from its claſſical appellation of *fagopyrum*.

Its leaf, from being at firſt roundiſh, takes nearly the ſhape of that of ivy, than which it is, however, longer pointed, and much ſofter. Its ſtalk is round, hollow, and weak, ſometimes reddiſh, but moſt commonly green; and it grows to the height of about two feet and a half; but on good, deep, light land, I have ſeen it grow to three feet and a half high. Lateral branches, which ſhoot out at almoſt every joint, are terminated by purpliſh flowers, which are ſucceeded by ſmall triangular ſeeds, black on the outſide, and white within. It will thrive on any ſoil, even on what are called barren ſands; but it grows largeſt on dry ground that has been well plowed. When raiſed for its grain only, a buſhel of ſeed is ſufficient for an acre of land; and, if drilled, which is far the beſt way of raiſing it for grain, half a buſhel of ſeed is enough, and will frequently yield fifty or ſixty buſhels. But when it is intended for green fodder, which is the uſe moſt commonly made of it here, it is then beſt to ſow it broad-caſt; and ſome people ſow three or four buſhels per acre, in order to have a thick crop; but this is too much, for if the crop is thick, it muſt be weak. The uſual time of ſowing it is, about the beginning of May; but Mr. Bartley, a correſpondent of the Bath Society, is of opinion, that this is too early; as I ſhall preſently have occaſion to obſerve. If there comes a warm ſeaſon, it will bear cutting twice in the ſummer. It comes up ſoon, and ripens in a ſhort time. When mowed, it muſt be left in the field ſeveral days, that its ſtalks may dry, before it is houſed. Its ſeeds do not eaſily fall off, nor is it much injured by wet. Theſe ſeeds are excellent food for pigeons, poultry, hogs, rabbits, &c. and are found to make horſes thrive, when given among their oats: but for them, they ſhould be juſt cracked in a mill; being apt, otherwiſe, to paſs through them whole. The flour of this grain is very white, and makes a good ſort of pancake, when mixed with a little wheat flour. The poor in ſome countries even make bread of this mixture: but it is black, bitter, windy, and not nouriſhing. Its ſtraw, or haulm, is alſo given dry to cattle: but the beſt way is to feed it whilſt green, particularly juſt before it bloſſoms. Milch-cows fed with it, will yield an extraordinary quantity of milk, remarkably good for making butter and cheeſe: and another advantage attending this paſture is, that it will continue green in the drieſt time of ſummer, when other graſs is burnt up. It is an excellent dreſſing for land, when plowed in without being mowed, and is the beſt reſtorative of an exhauſted ſoil: but it is a good way to feed it off with cattle for ſome time before it is plowed in, by which means their dung will help the land; and it will be eaſier plowed when trod down. The authors of the *Maiſon Ruſtique* obſerve, that pheaſants are exceſſively fond of this grain, and that many gentlemen in France ſow it in open parts of their woods, purpoſely to draw them thither.

*Mr. Bartley, whom I have quoted above, having about ſeven acres of a ſandy ſoil, on Briſlington common, a very rough piece of land, and juſt newly incloſed, cleanſed it firſt tolerably well from brambles, furze, &c. and gave it one plowing. To reduce the irregularities of the ſurface, it was rolled; and on the 9th of June 1780, it was ſown with two buſhels and a half of buckwheat per acre, when the ground was again rolled, without harrowing.

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* Bath Soc. Tranſ. Vol. III. p. 308.

The vegetation appeared in five or ſix days, as is conſtantly the caſe with this plant, be the weather wet, or dry. The growth was ſo rapid, that the fern, with which this land greatly abounded, was completely kept under. About the middle of September, this crop was mown; but by reaſon of a great deal of rain at that time, it was not ſecured until the beginning of October; hence, a loſs of great part of the grain, by ſhedding, as well as ſome eaten by birds. However, there were ſaved about twenty-four buſhels per acre, and, notwithſtanding its long expoſure to the weather, it received no ſort of damage, only, perhaps, that the fineſt and moſt perfect grain was the firſt to fall from the plant. The ground after this had almoſt the appearance of a fallow, and was immediately plowed.

When it had lain a moderate time, to meliorate and receive the influence of the atmoſphere, it was harrowed, ſown with Lammas-wheat, and plowed in under furrow, in a contrary direction to the firſt plowing. Thus, a piece of land, which, in the month of April was altogether in a ſtate of nature, in the following November was ſeen under a promiſing crop of what is well ſtiled, the king of grain; and this without the aid of manure, or of any very great degree of tillage. Nor was the harveſt by any means deficient; for ſeveral perſons converſant in theſe matters, eſtimated the produce at from twenty-ſix to thirty buſhels per acre; but the exact meaſure was neglected to be taken. As ſoon as the wheat crop was off, the ground had one plowing, and, on the firſt of September following, it was ſown with turnip-ſeed. The turnips were not large, but of an herbage ſo abundant, as in the following ſpring to ſupport one hundred and twenty ewes, with their lambs; which were fed on it, by folding, four weeks. After this, it was manured with a compoſition of rotten dung and natural earth, about twenty put (cart) loads per acre, and planted with potatoes. The crop ſold for one hundred and thirty-eight pounds; beſides a conſiderable number uſed in the family, and a quantity reſerved, with which ten acres were planted the following ſeaſon. In the enſuing ſeaſon, it was again ſown with wheat, and produced an excellent crop. In the ſpring of 1784 it was manured, and planted with potatoes, as in the preceding inſtance; the crop, though tolerably good, by no means equal to the former, producing only about an hundred ſacks per acre. This land is now, for the third time, under a crop of wheat: it being the intention to try how far this mode of alternate cropping, one year with potatoes, and another with wheat, may be carried.

From the ſucceſs of the preceding experiment, and various others made for ſeveral years by Mr. Bartley, buck-wheat is become with him a favorite object of cultivation; he being clearly of opinion, that it ought, in numerous caſes, to ſuperſede the practice of ſummer-fallowing: for the crop produced ſeems not only to be ſo much clear gain, but alſo affords a conſiderable quantity of fodder and manure: beſides, he is of opinion that a ſummer-fallowing is nothing-like ſo advantageous a preparation for a ſucceeding crop.

From its quick and luxuriant vegetation, buck-wheat is an admirable deſtroyer of weeds, and ſuits with a dry, light, and mellow ſoil, but flouriſhes moſt in a ſand. It is impatient of cold, or wet.

The proper ſeaſon for ſowing, Mr. Bartley takes to be from the middle of May to the middle of June. The laſt week of May, or firſt week of June, is perhaps ſtill better, as the leaſt froſt will cut off the plant at its firſt appearance; it being the native of a much warmer climate.

The uſe to which Mr. Bartley has hitherto applied the grain is, feeding of hogs; for which he eſteems it equal in value to barley. It is much more eaſily and conveniently ground than barley, as a malt-mill will grind it completely. Horſes are very fond of the grain; and poultry, of all ſorts, are ſpeedily fattened by it, as I have before obſerved.

Probably, ſays Mr. Bartley, it may hereafter be found a material article in diſtillation. After ſpring-feeding a crop of cole-ſeed, turnip-rooted cabbage, or vetches, there will be ſufficient time to ſow the land with buck-wheat. Perhaps a crop of vetches might be mown for hay, early enough to introduce a crop of this grain after it: but this can only ſucceed in a hot, dry ſummer. If, however, it is not in time to produce a crop of grain, it may be cut for fodder; or if even too late for fodder, it will ſerve for an excellent green dreſſing; ſo that, whatever way it is taken, ſtill it is profitable.

The bloſſom of this plant affords food for bees, at a very opportune ſeaſon of the year; when the meadows and trees are moſtly ſtripped of their flowers. As far as conjecture reaches, Mr. Bartley has ſeen a greater number of bees labouring at once upon his buck-wheat flowers, than could poſſibly belong to all the hives in the pariſh.

ESSAY V.

Of the Culture of Pulſe.

SECTION I.

Of BEANS.

THERE are properly but two ſpecies of beans, viz. the garden-bean, and the horſe-bean. The latter, which is our preſent object, delights in a ſtrong moiſt ſoil, and an open expoſure: for they never thrive well on dry warm land, or in ſmall incloſures, where they are very ſubject to blight, in particular, and are frequently attacked by an inſect which farmers call the black dolphin. Theſe inſects are often in ſuch quantities, as to cover the ſtems of the beans entirely, eſpecially all the upper part of them; and wherever this happens, the beans ſeldom, or never, do well: but it is rarely the caſe in open fields, where the ſoil is ſtrong.

Theſe beans are often ſown on land newly broken up, becauſe they help to looſen and pulverize the earth, and to deſtroy weeds: beſides, their large roots and ſtubble keep the ground hollow, and, when putrified, enrich it; ſo that it is thereby rendered much fitter for corn, eſpecially if the beans are drill ſown, or ſet in ſuch a way as to admit of horſe-hoeing; which will not only amazingly improve the crop, but alſo the land, as it is equal to a ſummer-fallow when well managed, as I have already ſhewn in the article of wheat: but where that cannot be conveniently accompliſhed, the hand-hoe ought to be employed twice or thrice in a ſeaſon.

The ſeaſon for ſowing beans is, from the middle of February to the end of March, according to the nature of the ſoil: the ſtrongeſt and wetteſt land ſhould always be laſt ſown. The uſual quantity of ſeed, in the old huſbandry, is about three buſhels to an acre; and the common produce about twenty buſhels.

When the land is newly broken up, the cuſtom is to plow it early in the autumn, to let it lie in ridges or bouts till after Chriſtmas, and then to plow it in ſmall furrows, and lay it ſmooth. Theſe two plowings will break it fine enough for beans, which, at the third, are ſown after the plough, in the bottom of the furrows, which ſhould not then be made above five, or at moſt ſix inches deep. This is the uſual method: though ſome lay their beans before the plough, and then plow them in: but, in either of theſe ways, they are ſet as cloſe as the furrows are made; which is much too near: for when they are on ſtrong good land, they are generally drawn up to a very great height, and are not ſo apt to pod as when they have more room and are of lower growth. Some trials made by Mr. Miller, convinced him, that it was much better to make the furrows two feet aſunder, or even more; that the beans will then branch out into many ſtalks, and bear in greater plenty: and the ſun and air having by ſuch means freer admittance between the rows, they will ripen much earlier, and more equally, than when they are planted cloſer together; as in the common way. But in either of theſe methods, care ſhould be taken to cover them perfectly with earth: for if a bean lies hollow, it waſtes itſelf before it reaches the mould, ſo as to ſhoot upward.

Some are of opinion, that the fertility of beans, is greatly increaſed by ſteeping them before they are ſown. This, however, ſhould be done with great moderation, leſt they ſwell and burſt in the ground.

If dried with wood-aſhes and ſoot, it would ſave them greatly from the depredations of inſects.

When they are drill-ſowed, the ground ſhould be prepared for them by plowing four times. This will break the clods, and render the earth fit for receiving the ſeed. The drill-plough ſhould then be ordered ſo as to drop the beans as regularly as poſſible, at two or three inches diſtance in the rows, by which method, little more than one buſhel of ſeed will ſuffice for an acre; but Mr. Cooke's allowance for his drill-plow is two buſhels; which I ſhould think rather too much.

In this county, they very commonly ſet their beans by dibbling, which anſwers extremely well; and is done at any diſtance the farmer may require, and kept in ſtraight rows by means of garden-lines, which they move with great expedition. The rows I have generally had ſet at eighteen inches diſtance, and the holes are at two inches diſtance in the rows, into which the dibblers or ſetters drop one or two beans; and this they do with great rapidity from practice; aſſuring me, that they could ſet wheat in this way ſooner than by any other mode preſcribed, only they could not be ſo ſure of the number of grains dropped into each hole, becauſe, from their ſmallneſs, they could not ſeparate them with their fingers. On ſome land I had beans ſet at two feet diſtance; and found my plants grew more vigorous and podded better, than when in cloſer rows. Hoeing, however, and moving the earth in the intervals, are ſtill more neceſſary to beans than to wheat; and if ſet at ſuch diſtances as to admit of the horſe-hoe, it will not only promote the growth of the beans, but be an admirable preparation of the land for a ſucceeding crop of wheat, for which purpoſe the beans ſhould be ſet extremely early in the ſeaſon, that they may be got off early. This can only be done to advantage in a favourable ſoil and forward ſeaſon; unleſs they be ſet in November of the preceeding year, when they are not only much earlier, but more productive, as we learn from Mr. Arbuthnot's experiments on them and wheat alternately.

When the beans are up, the ground ſhould be ſtirred between the rows, with the horſe-hoe, to deſtroy the young weeds; and when they are about four or five inches high, they ſhould be earthed up by another plowing between the rows. A third plowing, about five or ſix weeks after this, will keep the ground clean from weeds, and make the plants tiller and produce abundantly. An acre of beans cultivated in this manner, will yield at leaſt ten buſhels more than in the common method, in which laſt it may always be obſerved, that more than half their ſtems have no beans on them: for by ſtanding cloſe, they are drawn up very tall, and only the tops of the ſtalks produce, while all the lower parts are naked. Whereas in the ſetting or drill-ſowing modes, the joints of the ſtems are ſhorter, the pods conſequently grow nearer together, and they bear almoſt cloſe to the ground.

When beans are ripe, they are reaped with a hook, as is uſually practiſed for peas: though ſome think it beſt to cut them a little before they are full ripe, to prevent their ſhedding afterwards when they are moved. After having lain a few days on the ground, they are turned; and this muſt be repeated ſeveral times, until they are dry enough to ſtack: but the beſt method is, to tye them up in ſmall bundles, and ſet them upright: for this, we uſe tyers of the threads of old ropes or junk, and in this way, they will not be in ſuch danger of ſuffering by wet, as when they lie on the ground; and will be more handy to carry to ſtack, than if they were looſe. They ſhould lie in the mow to ſweat, before they are threſhed out; for as their haulm is very large and ſucculent, ſo it is very apt to give and grow moiſt: but there is no danger of the beans receiving any damage, if they are ſtacked tolerably dry; becauſe the pods will preſerve them from injury, and the ſweating makes them threſh more eaſily: for they will never give again, after they have once ſweated, and are again dry.

It is with beans of every kind, as with other plants, beſt to change the ſeed from time to time, and not to ſow and ſave the ſeeds of the ſame ſort long in the ſame ground; for they do not then ſucceed ſo well. Judicious huſbandmen are therefore ſtudious to procure their ſeed-beans from land of a different nature from that in which they are to be ſown; and find by ſuch means, their crops are larger, and their beans fairer, and leſs apt to degenerate.

I have ſeen mention made, in the Tranſactions of the Bath Soeiety, of a new kind of ſmall horſe-beans, ſent from Holland. A trial of them was made in very poor ground ill prepared. They were in general five feet high, and had from twenty to ſeventy pods on a ſtalk. Each bean, when counted, produced about one hundred and fourteen pods; and allowing three beans and a half to a pod, this makes three hundred and ninety-nine from one: which is an immenſe increaſe.

But to come nearer the truth, let us take it in another way. There were two quarts of theſe beans, weighing four pounds exactly, ſown in the above unfavourable ſituation; they yielded thirty-five gallons, Wincheſter meaſure, and weighed two hundred and ninety-ſix pounds nett of fine beans. This, in meaſure, is ſeventy for one; and in weight, ſeventy-four for one.

Mr. Sargent, who cultivated the land here ſpoken of, adds, that he thinks this bean a great bearer, and very hardy*.

There is another kind of horſe-bean, which, though only a variety from the bean which goes commonly by that name, yet deſerves particular notice; becauſe, in ſome caſes, it anſwers better than the other: it is called a tick-bean, is larger and flatter than the common horſe-bean, is very productive and hardy, with a ſhorter haulm: the ſame ſoil and management ſuits both kinds.

In treating of wheat, I mentioned the novel idea of alternate cropping. This too has been tried, in ſeveral inſtances, with beans; of which I ſhall here give ſome examples.

I have before quoted Mr. Anderdon's authority; and ſhall now give his account of an experiment of this kind†.

" My ſoil, ſays he, is a poor wet land, with a fall towards the north; value ten ſhillings per acre. This was very unfavourable to a turnip-crop; except by way of experiment to ſee what land would produce in the mode I propoſed to cultivate it.

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* Bath Soc. Tranſ. Vol. II. p. 253.

† Bath Soc. Tranſ. Vol. III. p. 125.

" In the year 1780, this field was drilled with turnips, in rows three feet aſunder. The ſeaſon being uncommonly wet, the crop was a very poor one; but the alleys between the rows being horſe-hoed, the Lent crop was put in on one earth.

" In January 1783, fourteen cart-loads of earth and dung were ſpread upon two parts of the field, that ſeemed poorer than the reſt.

" In March, it was plowed once, and ſowed with double rows of beans one foot aſunder, with alleys more than three feet wide between the double rows.

" In May, the alleys were horſe-hoed; and in the beginning of June, rolled with a ſmall ſpiky roller; then horſe-hoed again, harrowed, and ſown with turnips, the latter end of that month. The crop came up well, but was deſtroyed by the worm before the plants were in the rough leaf. The ſame alleys, without any farther horſe-hoeing, or plowing, were drilled a ſecond time with turnips on the 16th of July, and produced the crop ſhswed to the inſpectors. This crop was hand-hoed, the firſt time about the middle of Auguſt, and a ſecond time about a month after, when the plants were thinned out as near as poſſible to nine inches aſunder, and the alleys moved by going about (that is up and down) in each of them, with the ſhim, or Kentiſh horſe-hoe, which promoted the growth of the crop moſt amazingly. The turnips were of the Norfolk round white kind, having a few of the red mixed with them. The horſe-hoeing was done with one horſe, at the ſmall expence of ſix ſhillings the whole field; not fifteen pence per acre. The hand-hoeing coſt, the firſt time nine ſhillings and four pence halfpenny; the ſecond time ſix ſhillings and ſix pence halfpenny, or leſs than three ſhillings and five pence per acre. The produce of a ſquare perch, fairly taken, weighed two hundred weight, and ſix pounds, which is about ſixteen tons and a half per acre."

Mr. Anderdon next obſerves, that the expence of his horſe-hoeing and two hand-hoeings, together, did not exceed what the hand-hoeing alone would have amounted to, had the turnips been ſown in the common broad-caſt method, over the whole field; that the land was in excellent order for a Lent-crop, on one earth; and that he thought his crop was much greater than it would have been if ſown broad-caſt, and hoed by hand only, though in the moſt perfect manner; and doubted whether that field, in its then poor ſtate, would have produced a profitable crop.

It may, however, be replied to Mr. Anderdon, that lands of inferior value have produced from thirty to thirty-five tons of turnips: but they were light and ſandy: and, indeed, the circumſtance of ſoil makes the principal objection to this ſpecies of culture: for here we ſee two crops united, which require very different ſoils. For this reaſon, care ſhould be taken, in alternate crops of this kind, to unite two crops that require a ſtrong ſoil, or two that prefer a light one. Scotch cabbages might do well between the rows of beans, or perhaps, turnip-rooted cabbages; both of which agree with a ſtrong ſoil.

Mr. Anderdon then proceeds to inform us, that in this mode of ſowing, two ounces of good turnip-ſeed would be an ample allowance per acre, if the crop eſcaped its enemies, the worm, and the fly: but if they invade it, two pounds may be inſufficient. He ſowed upwards of fifteen ounces per acre laſt year, each ſowing: of the firſt, ſcarcely a plant ſurvived; and of the laſt, ſcarcely one plant in ten was permitted to remain, by the hand-hoers; and as the ſupernumerary plants are eaſily pulled out, or cut up in hoeing, it is beſt to drill ſeed enough to allow for devaſtation.

Mr. Anderdon alledges, that the advantages ariſing from this mode of cultivation in general, and the horſe-hoeing part of the proceſs in particular, are many, and ſtriking.

Firſt, that you may have a crop of beans, and of turnips, on the ſame land, the ſame year.

Secondly, the bean-crop being well horſe-hoed, no plowing is wanted for turnips; for which the beſt Norfolk farmers give five plowings.

Thirdly, the land is hoed cheaper, more effectually, and conſequently more profitably, than in any other way.

Fourthly, the ground is kept clean from weeds.

Fifthly, it is in order for a Lent crop the ſucceeding year.

Sixthly, the ground is kept in heart, if not improved, by fallowing the alleys.

Seventhly, it brings the plant to perfection in poor ground, where it would not become ſo otherwiſe.

Eighthly, according to his experience, it doubles the crop on any ground.

Ninthly, the crops are more within one's own power in this, than in any other method, let the ſeaſons turn out as they may.

Tenthly, you may have on the ſame ground, a bean and a turnip-crop annually, if the land be ſuitable, and you think proper.

Eleventhly, the clay-farmer, by this mode, renders land, which is naturally unfit for turnips, ſo free and open, by ſeaſonable horſe-hoeings, that it will bring that uſeful plant to great perfection.

Many of theſe advantages, ſays Mr. Anderdon, are peculiar to this mode of cultivation, excluſive of, and ſuperadded to, thoſe that attend the turnip crop itſelf.

I cannot however help being of opinion, with the Bath Society, that Mr. Anderdon is much too ſanguine in favour of this new plan; ſince he neither proves, that it is more productive than the common mode of cropping, nor that both crops are well adapted to the ſoils; nor that clayey lands are ſo well opened and mellowed, as when laid up in high ridges to the winter's froſts; which, on Mr. Anderdon's plan cannot be done; unleſs the turnips are leſſened in value, by being fed off in autumn.

This being the caſe, may I not aſk with propriety, whether it would not be a better mode of culture, to take a crop of beans alone, at proper intervals, for hand or for horſe-hoeing, on one field where the ſoil is ſuitable; and on another, field, to take a crop of turnips, either broad-caſt, or in drills?

If indeed it be tenable, what we ſhall preſently ſee advanced, viz. that the turnips ſowed with beans alternately are not ſubject to the ravages of the fly; this may be a reaſon for adopting the practice: but unleſs this is proved by experience, I can ſee no palpable advantage from this method.

Mr. Pavier, in a letter to the Bath Society,* ſeems at a loſs to determine whether this new mode adopted by Mr. Anderdon, or the old one practiſed in Norfolk, be actually of greateſt utility.

He reaſons thus, that the crop of turnips broad-caſt over the field, uninterrupted by the beans, twice hand-hoed, and ſet at fifteen inches diſtance, will certainly prove a more valuable crop than the beans and turnips together. On the other hand, he is of opinion, that the expence of drilling and horſe-hoeing the beans and turnips, in Mr. Anderdon's way, muſt be conſiderably leſs, than that of fallowing and preparing the ground for ſowing the turnips in broad-caſt; beſides the much greater facility in hoeing the drills in the former manner.

To this he adds, that there is one conſideration more in favour of drilling between the beans, which has great weight; namely, the probable chance, if not almoſt certainty, of preſerving the turnips from the depredations of the fly: for, from Mr. Anderdon's ſucceſs in this way, he ſuppoſes the beans to be an almoſt certain preventive. But the Bath Society, with great appearance of truth, doubt of the certainty of this effect; and rather attribute Mr. Anderdon's ſucceſs, with reſpect to the fly, to ſome other accidental cauſe.

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* Bath Soc. Tranſ. Vol. III. p. 142.

If, ſays Mr. Pavier, the crop of drilled beans, as above, after deducting the ſeed, and ſome additional expence in taking the crop off the ground without injuring the turnips, can be, one year with another, ſuppoſed as valuable as the ſurplus quantity of turnips produced by the broad-caſt method; he would not, in that caſe, heſitate to declare in favour of drilling between the beans.

This point can only be ſettled by experiment: and in order to decide, the value of the turnips per ton ſhould be aſcertained. Mr. Pavier fixes their value thus. A ſheep will eat twenty pounds of turnips in twenty-four hours: a ton of turnips will therefore maintain this ſheep one hundred and twelve days, or ſixteen weeks; which, at four pence per week, is five ſhillings and four pence; a price he thinks they may be fairly valued at, when drawn off the field.

*Mr. Bult, of Kingſton, near Taunton, tried alſo this alternate mode of beans and turnips; and gives the following account of his experiment.

The field meaſured ſix ſtatute acres and a half of good clayey ſoil. The beans were planted in drills near two feet apart, on two plowings, and horſe-hoed three times, the turnips being ſown in

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* Bath Soc. Tranſ. Vol. III. p. 278.

the intervals at the third or laſt hoeing. There was no manure or dreſſing laid on the land, for the ſix ſucceeding crops, nor was there any need of it; as Mr. Bult found from experience, that drilling and horſe-hoeing fully anſwered the end.

The crop of beans was near three quarters per acre, and the weight of the turnips, as meaſured and weighed by Mr. Pavier and Mr. Headford, was thirty-ſeven tons, five hundred weight, per acre. Theſe turnips, ſays Mr. Bult, are now feeding off: thirty-one head of horned cattle, ſixty-ſeven ſheep, and twenty-ſix pigs, have been maintained wholly by them for a month paſt, and what remains will keep them at leaſt a month longer. The expence of drawing and carting them into an adjacent field, was between ſix and ſeven ſhillings per acre.

Mr. Pavier, above quoted, who ſaw and weighed this crop, makes the following remarks upon it.

This field, ſays he, has been under a courſe of drill-huſbandry for five or ſix years ſucceſſively; during which time, it has had no manure, or top-dreſſing. The turnip-ſeed was ſown about Midſummer, after the third hoeing; from which time nothing was done to the field, but drawing the beans and carrying them off. The crop was thought to be above twenty buſhels per acre, which was conſiderably above the common produce in the neighbourhood. The turnips, from a fair trial weighed, were calculated, as before mentioned, at thirty-ſeven tons, five hundred weight, per acre.

When it is conſidered, that here was no crop loſt, no preparation, no dreſſing, nor any expence whatever, except ſeed and ſowing; it muſt be allowed to have been a very profitable crop, and entirely owing to the cleanneſs of the ground, by frequent hoeings. It is, ſays Mr. Pavier, one of the beſt recommendations of the drill huſbandry I have ever ſeen or heard of.

Mr. Pavier had alſo heard of two more inſtances of ſimilar crops; where the turnips were very good, and the beans more than double the value of thoſe raiſed in the common way. He thinks it evident, that the beans preſerve the turnips from the fly; but that it can never anſwer, unleſs the ground is made very clean; and that the rows of beans ſhould be more than two feet apart.

It ought here to be obſerved, that this laſt experiment is made on a ſoil very different from that of Mr. Anderdon's; and therefore the reflections made on his operations do not altogether apply to the preſent caſe.

I ſhall now proceed to relate what Mr. Winter ſays on this ſubject, in a letter to the Bath Society.*

A field of about ſeven acres was ſo barren, that he could not let it for ten ſhillings an acre; the ſoil about four inches deep, on a very ſtiff clay, had about nine years before been greatly impoveriſhed, by burning and improper cultivation. By Mr. Winter's management, it produced twenty-eight buſhels and a half of excellent cone wheat per acre, one hundred and forty of which, he ſold for ſeed at ſeven ſhillings and nine pence per buſhel. Time did not permit his plowing up the ground before the beginning of December, and it was then done careleſly, in irregular ridges, from four feet and a half to ſix feet wide, as he intended it to be plowed twice more in the ſpring. The ſevere froſt fruſtrated his intention; for the field could not be cultivated before April. The ſurface was well pulverized by the froſt, but, upon trial, the under ſtratum was of too hard and conſolidated a texture, to afford the leaſt expectation of ſucceſs by farther plowings. As the ſeaſon was ſo far advanced, he ventured, in that condition, rather than loſe the opportunity of a crop, to drill in horſe beans, two buſhels to an acre, in the beſt manner he could, in rows twenty ſeven inches apart, three inches deep, and three inches diſtant in the rows, with irregular intervals between thoſe different ſized ridges; which drilling was performed in eight hours, on the twentieth of April.

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* Bath Soc. Tranſ. Vol. III. p. 285.

The beans appeared in a very ſhort time, ſuperior to any planted by hand in the neighbouring fields.

On the twenty-ſixth and twenty-ſeventh of May, the whole field was hoed with an inſtrument containing three triangular flat ſhares, fixed in a plank, with a ſhort beam and wheel to render the working ſteady, and govern the depth, being about two inches: this cut the weeds; the three ſhares, clearing the breadth of near two feet, and being guided by handles, the ſame as a plough. The ſecond hoeing was performed as before, on the twenty-ſixth and twenty-ſeventh of June. It was after this worked with a ſmall horſe drag-rake, three inches long and eighteen inches broad, with handles to guide it. The third hoeing was executed with a Norfolk plough, turning the looſened mould to the beans. He had the ſatisfaction to find his ground work well during the exceſſive dry ſeaſon, and, on examining other grounds managed in the common way, found his crop far ſuperior, as could be proved by farmers of credit and reputation. He could not then aſcertain the produce, as not having had them threſhed; which ought not to be performed till near Chriſtmas: it being neceſſary to let them remain in ſtack till about that time, before which they would not be ſufficiently hardened. Mr. Winter might have added, that frequently, in a wet autumn, beans remain unfit for threſhing till after the Lady-day enſuing.

He ſays he has experienced, that horſe-beans at four inches diſtance in ſingle rows, about two feet ſix inches, to eight inches, apart, are much more advantageous than having any thing planted or ſowed in the intervals, when the land is intended for a ſucceeding crop of wheat: becauſe ſuch intervals admit of frequent horſe-hoeings, by which the land afterwards requires only being formed into proper ridges for wheat.

If the beans are to be ſucceeded by a crop of wheat, this obſervation of Mr. Winter's is certainly a juſt one: but a crop of beans is generally ſo late of being got off the ground, and a crop of wheat, particularly when drilled, requires being ſowed ſo early, that I think the one ought not to follow the other, when it can be conveniently avoided. Mr. Bult's method above related, when the ſoil will anſwer, is ſurely the way to make the moſt of the land: for the turnips or cabbages, or other intermediate crop, if I may be allowed the expreſſion, fills up that ſpace of time from the reaping of the beans, until the plowing for barley, or white oats, or buck-wheat.

I muſt here alſo beg leave to remark, that all the above mentioned cultivators of beans ſeem to me to drill their rows too cloſe; particularly thoſe who take an alternate crop. I ſpeak from experience: for having ſet a ſmall field of beans at two feet diſtance in the rows, with a view to try an alternate crop, I found, by the time of the third hoeing, they had tillered and ſpread to ſuch a degree, that nothing could have grown between them; and I was thus obliged to deſiſt from my experiment.

The principal uſe of horſe-beans is implied by their name; but, as they are of a hot nature, care ſhould be taken, not to give them in too great quantities to that valuable race of animals. Their ſtalks, or haulm, is alſo uſed ſometimes for fodder, in countries where there is a ſcarcity of graſs; and when plowed in green, for which purpoſe only they have been frequently ſown, they prove an excellent manure.

Some trials have been made, both in this country and in France, of the culture of Windſor beans and Kidney-beans in the field; and wherever the ground has been well prepared for them, and kept clean by horſe or hand-hoeing, as before directed, they have anſwered perfectly well.

There can, indeed, be no reaſon why they ſhould not ſucceed as well in the field as in the garden; for the field, by this new and admirable ſpecies of culture, is now become *a ſpacious garden.*

SECTION II.

Of PEAS.

MR. LISLE, for the greater eaſe and more certain guidance of country people, who are apt to be perplexed by a long liſt of the different ſorts of field peas, and their numerous varieties, very ſenſibly ranges them under two general heads, viz. the tender and the hardy ſmall ſort, and the tender and the hardy great ſort; under the one or the other of which claſſes, all kinds of peas may properly be ranked; becauſe they equally agree, or diſagree, with the ſame ſoil. The tender pea, for example, is improper for a cold country, or for cold ground in a warm country: and the large pea, by reaſon of its great haulm, is not proper for ſtrong rich land; becauſe its haulm will there grow to ſo great a length, that it will be unable to bear pods. The beſt way to make peas pod well, is to ſow them on a mellow mould, rendered light by plowing; and to roll the ground ſoon after they are ſown.

Perhaps, even at this period, when Agriculture is certainly better underſtood in Great-Britain than it ever was before, in any age or in any country, it is not going too far, to ſay, that actual experiments, properly diverſified, are ſtill much wanted in the culture of peas; and indeed of moſt other podded grains, and ſucculent plants; whoſe importance, as deſtroyers of weeds, improvers of land, and excellent preparers of it for other crops, is eſtabliſhed beyond diſpute. Peas, in particular, have been found to be ſuch enrichers of the earth, and to prepare it ſo well for corn, that the reverend Dr. Elliot, of New-England, ſays, he has many times known farmers in that country, invite others, who had peas, to ſow their land without paying any rent, merely for the advantage it would be of, to their crop of wheat*. It is even a rule with farmers, not to ſow the ſame land a ſecond time with peas, till ſix, or at leaſt five years after the former crop; becauſe, till then, the ground on which they grew will continue ſo rich, as to make them run luxuriantly to haulm, and prevent their bearing much fruit.

The common white pea does beſt on light, ſandy land, or on a rich looſe ſoil. It is generally ſown with a broad-caſt, and only harrowed in. Three buſhels of theſe peas are the uſual allowance of ſeed to an acre of ground; and the common time for ſowing them is about the latter end of March, or the beginning of April, on warm land: but a fortnight or three weeks later than this, will be early enough on cold ground. If ſown in drills, which is by far the beſt way, a buſhel and a half of ſeed will be full enough for an acre. Mr. Cooke allows two buſhels for his plough; and when they are thus drilled regularly, the ground ſhould be well ſtirred with a hand or horſe-hoe, as before deſcribed. The weeds will be thus deſtroyed, and the plants earthed up; by which they will be greatly improved, and the peas will be much eaſier to cut in autumn, when they are ripe.

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* Eſſays on Field-Huſbandry, p. 112.

The green, and the maple rouncivals require a ſtronger ſoil than the white, and ſhould be ſown a little later in the ſpring, in drills alſo; but farther aſunder, that is, at the diſtance of two feet and a half, at leaſt, better if three feet, being apt to grow rank, eſpecially in a wet ſeaſon. The ground between the rows being ſtirred in the uſual manner with a hand or horſe hoe, will not only improve the crop very much, but will alſo render the land fitter to receive whatever is ſown in the following ſeaſon.

The grey and other large winter peas, as they are called, are ſeldom cultivated in gardens, becauſe they require a great deal of room. They ſhould be ſowed about the beginning of March, when the weather is pretty dry; for if they are ſowed in a very wet ſeaſon, they are apt to rot, eſpecially if the ground be cold. The diſtance between the rows of theſe peas ſhould be three feet or three feet and a half; and they ſhould alſo be ſown very thin; for if otherwiſe, their haulm will ſpread and fill the ground, and they will ramble over each other; by which means many of the plants will be rotted, and hindered from bearing. One buſhel and a half of ſeed is ſufficient for an acre of land.

All ſorts of peas love limed or marled ground: but when they are ſown late in the ſeaſon, the ſoil ſhould be ſtrong and moiſt; for they will burn up and periſh in hot light land, or at leaſt produce a very poor crop. Some farmers approve of ſteeping peas in water twenty-four hours, before they are ſowed. This will give an opportunity to ſkim off the faulty ſeeds, which riſe to the ſurface, and in caſe of dry weather after ſowing, it will enable them to riſe the ſooner, by being thus moiſtened: but when this is done, I would always recommend to dry them with ſoot, to prevent, as much as poſſible, their becoming a prey to birds and inſects. In general, the larger the pea, the later it is of ripening, and conſequently ſhould be the earlier ſowed.

Moderate rains are of ſingular ſervice to peas while they grow, particularly at their time of bloſſoming and filling up their pods : but a continuance of cold rain for many days is perhaps as prejudicial as too much heat or drought. The blueiſh bloom on their leaves, and their expanding backwards the outermoſt and largeſt leaves of their bloſſoms, are undoubted ſigns of great health and vigour. Mr. Liſle is of opinion, that they neither ripen, nor harden, ſo well upon high grounds, as in valleys; and conſequently, that the former are not ſo fit for keeping as the latter. But I cannot help regarding this as a frivolous obſervation; ſince ſo much depends upon ſoil, rather than ſituation.

Mr. Villiers, a correſpondent of M. du Hamel's, ſowed a ſmall field of peas, in double rows, in Champagne. Not having a proper inſtrument for horſe-hoeing, they were done in an awkward manner; yet ſuch was the good effect of this imperfect hoeing, that while almoſt all the peas in his neighbourood were that year deſtroyed by a kind of vermin called vine-fretters, his were hurt the leaſt of any. This was moſt probably owing to the greater vigour of the plants, or the inſects being killed, or diſturbed by the ſtirring of the ground. From a compariſon which he made of the produce of this ſpot, he found that it yielded ſix times as much as the ſame extent of the beſt land in the ſame country. In a good year, ſays M. du Hamel, the difference would not have been ſo great: but this experiment ſhews, that plants cultivated in the new way are better able to reſiſt the inclemencies of the ſeaſons, and other accidents, than thoſe which are cultivated according to the old method.

The ſame gentleman drilled peas in a ſtrong, heavy ſoil, in which no one had ever ventured to ſow any in the common huſbandry. They grew as high as if the ground had been ever ſo fit for them, and yielded half as much again as any ſown in the common way, beſides the ſaving in the ſeed, which, in peas thus drilled, is about one half. They were ſown in double rows, with a ſpace of two feet and a half from one double row to the other; and this ſpace was ſtirred with the horſe-hoe.

Mr. Winter, whom I have already quoted, has given us an account of his having ſowed peas on a field newly broken up. The ſoil was extremely unfavorable, being rather wet, and only ſix inches deep, on a ſtiff, ſtony clay. He ſowed two buſhels per acre, at twenty-ſeven inches diſtance between the rows: the produce was twelve buſhels only; but the ground was prepared by them for a crop of drilled wheat.

Mr. Boote has given us a more favorable account of his produce from a light ſandy ſoil, drilled with peas by Mr. Cooke's drill-plough, after a crop of barley. This experiment brought upwards of fifty buſhels per acre, and proves very ſufficiently the advantage of drilling and hoeing peas.

When any particular ſorts of peas are intended for ſeed, they ſhould be carefully looked over whilſt in flower, in order to draw out all ſuch plants as are not of the right ſort; for there will always be, in every ſort, ſome roguiſh plants, as they are called, which, if left to mix, will degenerate the kind. As many rows as may be thought ſufficient to furniſh the deſired quantity of ſeed, ſhould then be marked out, and left till their pods turn brown, and begin to ſplit; when they ſhould be immediately gathered up, with the haulm; and if the huſbandman has not room to ſtack them till winter, they may be threſhed out, as ſoon as they are dry, and put up in ſacks for uſe: but particular care ſhould be taken, not to let theſe remain too long abroad after they are ripe, becauſe wet would rot them; and heat, after a ſhower of rain, would make their pods burſt, in ſuch manner, that the greateſt part of their ſeeds would be loſt. Theſe precautions are, indeed, more eaſily obſerved in the garden, than in the field, where large quantities are raiſed; but they are alſo highly proper in this laſt, and will well reward the extraordinary pains of the huſbandman; who, as in other crops, ſhould be careful to change his ſeed almoſt every year.

When peas are reaped, which is commonly done with a long ſtick, or with a reap-hook, they are laid up in ſmall heaps, and left in the field, till their haulm and pods are dry: but during this time, they ſhould be turned frequently, and raiſed from the earth as much as can be, that they may lie hollow for the wind to dry them; eſpecially when any rain happens to wet and beat them down. In Leiceſterſhire, they ſet all their peas abroad in ſtacks, and houſe none; becauſe, they think ſetting them abroad gives them a good colour, and that laying them in a barn makes them look dark. In ſome countries, they mow their peas: but that is ſurely a bad practice, as the ſcythe muſt cut many pods, and be the means of ſhedding great part of the grains.

SECTION III.

Of VETCHES, or TARES.

THE vetches beſt known to the farmers in this country, are diſtinguiſhed only by the names of the black and the white, the winter and the ſummer vetch.

Some ſorts of this plant, the ſeeds of which ripen in autumn, grow naturally in moſt parts of England, in ſhady places, among buſhes, and by the ſides of woods. The roots of theſe are perennial; but their ſtalks are annual, weak, and grow to ſo great a length, that they are hardly fit to be cultivated: though ſome writers have recommended them for this purpoſe.

They will climb to the vaſt height of ſix or eight feet, wherever the tendrils which proceed from the ends of their leaves, can lay hold of boughs, branches, or the ſide of a hedge, to ſupport them. But in the field, where they could have no ſupport, they would trail upon the ground, and be apt to rot: nor do their ſhoots, which are leſs ſucculent than thoſe of the vetch commonly raiſed, grow to a ſufficient height to be cut for uſe, till late in the ſpring, when there is little want of green food for cattle.

Mr. Miller, after ſowing for many years the common vetch, or tare, which is much cultivated in the fields for fodder, ſeems to think that which has black ſeeds a diſtinct ſpecies from the white; for he never found either of them vary. Both are annual, and periſh ſoon after they have perfected their ſeed.

The white vetch is rather the more ſucculent plant of the two, and is therefore beſt for fodder: but many are unwilling to cultivate that ſort, becauſe the ſeeds, being white, are ſooner diſcovered and more eaſily devoured by rooks and other birds, than the black, which bear a nearer reſemblance to the colour of the ground. This, however, can be only an objection when they are ſown broadcaſt; and is beſt removed by ſowing them in drills, and covering them with care.

The ſmall black-ſeeded vetch, which ſome call rath-ripe, and others pebble, or ſummer vetch, is more tender than either of the former, and is therefore leſs cultivated. This muſt always be ſown in the ſpring: whereas the others may be ſown either in ſpring or autumn.

But Mr. Miller mentions another ſpecies of vetch, which he calls the Siberian, little known to farmers, but of which he ſeems to have formed a very high opinion. When he wrote, however, he had not then tried them in the field, but only in ſmall patches in gardens, in different ſituations, where they fully anſwered his expectations; for he found theſe plants continue in great verdure in all thoſe places, when moſt of the perennial plants, in the ſame ſituation, ſuffered greatly by the froſt; and he could have cut from only eight of them, as much fodder as would have made half a truſs of hay.

If we had been ſo fortunate as to have known from ſo great an authority as Mr. Miller's, the reſult of his experiments in the field culture of this plant, it would have been extremely ſatisfactory; as from the deſcription of it given by him, it promiſes to be of the greateſt utility.

*Another perſon who had a few ſeeds of Mr. Miller, tried this vetch in his garden, without ſucceſs. He ſowed them againſt a ſouth wall, where they came up weak and ſlender, and required ſupport: they ran up pretty high, and the ſecond year advanced to about five feet, and produced ſome ſeed. But they had very few leaves on their ſtems, and thoſe which came out near their tops were thin and dry; the ſtems and branches were alſo dry and wiry; ſo that he had no opinion of them as fodder for cattle, eſpecially as they wanted

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* Complete Farmer, Article *Vetch.*

to be ſupported: and this prevented his proceeding in the culture of them.

This gentleman, however, ſeems to have been too ſoon intimidated; for the weakneſs and leafleſſneſs of theſe plants might have been owing to the ſituation, expoſed to the reflection of the ſun from a ſouth wall; without conſidering, perhaps, that this plant is the native of a northern climate, and was rendered feeble and leafleſs by being puſhed into a rapid vegetation. Deſirous therefore of making farther experiment on a plant ſo well recommended, I made enquiry of all the ſeedſmen in town, in order to procure a few ſeeds of it, but in vain; for they neither knew any thing of the ſeeds, nor of the plant itſelf.

Thus we are ſtill in the dark about this plant, from which Mr. Miller ſeems to have expected ſo much, and of which he gives the following intereſting deſcription. The ſtalks of the Siberian vetch grow to a great length, and are well furniſhed with leaves, which do not decay in autumn, like thoſe of other ſorts, but continue green all the winter, in defiance of the hardeſt froſt; ſo that in February and March, when there is a ſcarcity of green fodder, this may be of ſingular ſervice; eſpecially if theſe plants are ſupported from trailing on the ground.

Their flowers, which appear in July, are of a light blue colour.

This, like our common vetch, may be ſown in the ſpring, or in autumn: and when the plants are come up, they will not require any other culture than keeping them clear of weeds; a work which may entirely be done with the hand-hoe the firſt time, and afterwards with the horſe-hoe: for, to cultivate them properly, Mr. Miller rightly adviſes, to drill them thinly in rows four feet aſunder. By this thin ſowing, the ſtalks of theſe vetches, which ſend out many branches and extend very far, will be kept from matting ſo cloſely together, as to rot each other by excluding the air; and by earthing up the ſtems, in the ſame manner as ſhould be done for peas and beans, they will be greatly ſtrengthened, their leaves will grow the larger and more ſucculent, and they will conſequently yield an increaſed quantity of fodder. The repeating of this as often as it may be found neceſſary, to deſtroy the weeds in the ſummer, will be attended with the farther advantage of preparing the land, in the beſt manner, for a ſucceeding crop.

As the plants of this kind of vetch, continues Mr. Miller, will not be in any danger of being hurt by froſt, they ſhould not be cut till the ſpring; when the beſt way will be to take them freſh and freſh, as they are wanted for cattle.

Thoſe wanted for ſeeds ſhould be ſown in a ſeparate ſpot of ground; becauſe, when a field of them is cut, it muſt be plowed for another crop, and does not admit of any remaining to ſeed upon the ground. This vetch, when plowed into the land, would make an excellent green dreſſing.

Beſides the above, there is another vetch nearly in the ſame predicament; I mean, much recommended, and but very little known. It is mentioned by the Rev. Mr. Swayne, in a letter to the Bath Society,* where it is deſcribed as a plant of the claſs *diadelphia* of the Linnæan ſyſtem, the order *decandria*, and *genus*, *vicia*: the root is perennial, fibrous, and branching; the ſtalks are many, ſome of them ſhooting immediately upwards, others creeping juſt beneath the ſurface of the ground, and emerging ſome near to, and others at a conſiderable diſtance from, the parent ſtock. The ſmall oval leaves are connected together by a mid-rib, with a tendril at the extremity; the flowers are in ſhape like thoſe of the common vetch, of a reddiſh purple colour; the firſt that bloſſom, uſually come in pairs; afterwards, to the number of four at a joint: the pods are much ſhorter than thoſe of the common vetch, larger in proportion to their length, and flatter, and are of a black colour when ripe: the ſeeds are ſmaller than thoſe of the cultivated ſpecies, ſome ſpeckled, others of a clay colour.

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* Bath Soc, Tranſ. Vol. III. p. 71.

Being a perennial, it ſhould ſeem to be a very proper kind to intermix with graſs ſeeds, for laying down lands intended for paſture: and it is ſurely intitled to this appellation, ſince Mr. Swayne has obſerved a patch of it growing in one particular ſpot of his orchard for theſe fourteen or fifteen years paſt.

It is not only a perennial, but an ever-green: it ſhoots the earlieſt in the ſpring of any plant eaten by cattle, vegetates late in autumn, and continues green through the winter, though the weather be very ſevere: add to this, that cattle are very fond of it. Theſe peculiarities, it ſhould ſeem, would make it particularly valuable to the farmer, as a green food for his ſheep in the winter and ſpring, when food of that denomination is ſo exceedingly ſcarce. Mr. Swayne wondered, that with all theſe uncommon qualities, this plant had never found its way into general cultivation; but upon a cloſer examination, ſoon found out the cauſe of it. The obſtacle ariſes from the difficulty of procuring good ſeeds in any quantity. The pods do not ripen equally; and when ripe, they burſt with great elaſticity, and ſcatter the ſeeds. Likewiſe, after the ſeeds are procured, ſcarce one third of them will vegetate; owing to a defect, occaſioned by certain inſects making them the neſts and food for their young.

Mr. Swayne, having collected a quantity of theſe ſeeds from the hedges &c. ſowed them in drills, March 15, 1783, in a plot of ground five yards ſquare, about the thickneſs of peas.

They came up very thin and irregular; in ſome places there was a foot vacancy from plant to plant. They grew very ſparingly till towards autumn, but made a tolerable appearance before winter. The ſoil was a blackiſh loam, rather ſtiff, and had been planted with potatoes the year before. Mr. Swayne diſcovered, that the inſects which ſpoiled them were the *ichneumon* and *bruchus piſi* of Linnæus; a near relation of the weevil.

After the froſts were over, ſcarce a plant had ſuffered by them, and their verdure was very little impaired. In April 1784, they had entirely filled up the ground and were beginning to flower. In the beginning of May, they were in full bloſſom, and there was an amazing croud of inſects ſwarming about them. They were cut twice during the ſummer; and Mr. Swayne having obſerved that the produce was very great, determined to keep a particular account of it the next year. Accordingly, he cut them on the 17th of

March, 1785; a ſecond time, the 17th of May; a third time the 21ſt of July; and a fourth time the 30th of September.

The whole plot, of twenty-five ſquare yards, produced,

1ſt cutting	16lb.	green	4lb.	dry.
2d ditto	130	ditto	$21\frac{1}{2}$	ditto
3d ditto	62	ditto	14	ditto
4th ditto	$76\frac{1}{2}$	ditto	$12\frac{1}{2}$	ditto
Total	$284\frac{1}{2}$	green	52	dry.

An acre, at the ſame rate, would have produced

24 tons	11 cwt.	3 qrs.	3 lb.	green,
4	9	3	15	dry fodder.

N. B. At the time the firſt cutting was made, there was ſcarce a green blade of graſs to be ſeen.

This account of the buſh-vetch by Mr. Swayne is extremely curious, and ſhews how very deſerving it is of farther experiment.

But to return to the common vetches. Theſe are generally ſown either in autumn or in the ſpring: but the beſt time in this country is, towards the beginning of Auguſt; becauſe the rains which uſually fall about that ſeaſon, will bring them up in a ſhort time, and the plants will get ſtrength before winter, and be fit to cut for the food of cattle early in the ſpring, when green fodder is moſt wanted: and if they are deſigned for ſeed, theſe early ſown vetches will come ſoon into flower and their ſeeds will ripen early, ſo that they may be cut and threſhed in good weather, which is a great advantage; for thoſe which ripen late, are often ſtacked or houſed wet, and then their ſeeds often ſprout in the mow, and are ſpoiled.

Vetches will do well in almoſt any ground; not excepting even ſuch as can ſcarcely produce any other plant. The common method of ſowing them is broad-caſt, plowing them in lightly; and the uſual allowance of ſeed is two buſhels to an acre; ſome give two buſhels and a half. Either of theſe may do for vetches which are intended to be cut for fodder in the ſpring: but when they are ſown with a view to let them ſtand for ſeed, it will be much better to ſow them in drills, in the ſame manner as is practiſed for peas; and in this caſe, leſs than half the above quantity of ſeed will be ſufficient: for the rows ſhould be at leaſt three feet aſunder, that the horſe-hoe may have room to go between them to deſtroy weeds and earth up the plants, which will have the uſual good effects, of making them ripen better and ſooner than in the common way. The drills ſhould be of the ſame depth as for peas, and the tares ſhould be dropped in them as thinly, and carefully covered over as ſoon as ſown; otherwiſe they will be diſcovered and deſtroyed by the rooks; and therefore they ſhould be watched, till out of danger. This is one reaſon for ſowing them early in autumn, rather than at any other ſeaſon; for there is then an abundance of other food in the field for rooks and pigeons, and the plants riſe ſooner out of the ground.

Towards the end of October, if the weather be dry, the horſe-hoe ſhould get to work between the rows, and care ſhould be taken to lay up the earth as high as poſſible to the ſtems of the plants, without covering their tops. This will ſecure them againſt froſt, and clear the ground of weeds till March, when the ſame operation ſhould be repeated. This will make them grow ſo vigorouſly, that they will meet and cover the ſpaces in a little time: whereas thoſe ſown in ſpring will not grow to half this ſize, and will be very late in flowering.

When vetches are intended for fodder only; of which they generally afford two crops in the year, in hot countries; or when the farmer deſigns them for plowing in, by way of manure; they need not be ſown in drills, or managed in the manner above directed: the common broad-caſt way will then anſwer the purpoſe: but ſtill it is moſt adviſeable, in either caſe, to ſow them early in autumn; becauſe, in the firſt place, they will produce the green fodder much earlier in ſpring; and, in the ſecond, they will be fit to plow in much ſooner the following autumn, and thereby have more time to meliorate the land, and prepare it for the enſuing crop. Stiff clays are peculiarly benefited by this dreſſing: but it is bad huſbandry to ſow vetches for green fodder, where lucerne will thrive; for this will yield greater plenty of ſtill more nouriſhing food.

In ſome countries, they mix oats with their tares, an equal quantity of each, and ſow them in February. The tare, ſupported in ſome meaſure by the oat, grows the higher for it: and about the middle of May this mixture is mowed, and given to horſes, and other cattle, which it fattens greatly. Mr. Mortimer thinks it a good way to ſow horſe-beans and tares together: their ſeeds are eaſily parted with a redder: but I can ſee no advantage in this mixture, except that the beans help to ſupport the tares; but on the other hand, I ſhould think the tares would injure the beans much, by climbing up and adhering to them.

Mr. Mortimer, and the writers of the *Maiſon Ruſtique*, make another obſervation, viz. that no more vetches ſhould be ſown at any one time, than can be covered the ſame day; becauſe the dew is apt to ſpoil them: conſequently, they ſhould not be ſown till two or three hours after the riſing of the ſun; by which time the moiſture will be exhaled from the ground. But though theſe ſeeds cannot bear damp, which would ſoon rot them; yet the plants, eſpecially in ſandy land, often periſh in dry years for want of water. To make them flouriſh well, they require a ſhower of rain every ten or twelve days. One plowing to turn in the ſtubble of the preceding crop, and another at the time of ſowing, are ſufficient for this plant: but thoſe who give only one plowing, when they ſow, and afterwards harrow in the ſeed, neither have, nor can expect, an equally good return.

When vetches are cultivated for their ſeeds, they ſhould be cut ſoon after the pods turn brown, and ſtacked as ſoon as dry: for if they are ſuffered to lie in the field till they receive wet, and there comes a hot day, moſt of the pods will burſt. Their haulm, when dry, and threſhed, is eſteemed good for cattle; and ſome are of opinion, that their ſeeds are as good for horſes, as beans: this ſhould render them the more valuable, as they will grow on the lighteſt ſandy land, where beans will not thrive. I have no experience of their utility in the feeding of horſes: but nothing fattens hogs or ſheep ſooner, or better; and a ſmall quantity, mixed with malt-duſt, or bran, in the winter, makes an excellent trough-meat for ewes in lamb, or when lambed: they are therefore an uſeful plant to any farmer; and the more ſo that they will ſucceed on ſoils where neither peas nor beans will anſwer. It is indeed ſaid, that the farmer cannot ſow any thing more profitable than vetches; for beſides enriching the land, a crop of them will go farther than two loads of hay.

Mr. Liſle is of a contrary opinion, and calculates that an acre of broad clover is worth twenty ſhillings a year more than an acre of any vetches. Mr. Liſle, however, ſhould have conſidered, that vetches may be ſowed on land in leſs perfect tilth, and that they will tend greatly to meliorate and clean that land; which clover will not do.

Vetches, when threſhed out, will be as good for ſowing at the end of five or ſix years, as at firſt, if care be taken to turn them in the heap from time to time. Mr. Mortimer cautions the huſbandman to keep them ſeparate from his other corn, leſt they foul it. Three loads of vetches, per acre, are reckoned a good average crop.

Before I cloſe my account of vetches, I muſt add a few obſervations from ſome of the correſpondents of the *Muſeum Ruſticum*. Mr. Smith, an Eſſex farmer, juſtly remarks, that it would be a great national advantage, if our ſtock of cattle and ſheep could be increaſed, without diminiſhing our quantity of lands in tillage. This, ſays he, can only be accompliſhed by the culture of artificial graſſes. The evident advantage of the turnip huſbandry has now rendered it very general. The coleſeed plant has alſo its utility, and in many places is as univerſally ſown as the turnip. It anſwers well for feeding ſheep, as alſo for the ſake of its ſeed: it anſwers well for a crop to overpower, choak, and deſtroy weeds.

The burnet graſs may probably ſucceed, and the culture of it become univerſally adopted. But the principal thing Mr. Smith had in view was, to recommend the uſe of vetches as food for cattle; and alſo as a preparation for wheat, becauſe they choak and deſtroy weeds, and are next to a hoeing crop for this purpoſe.

He often cut his vetches green, for food to his horſes in the ſtable: they throve well, grew fat, and were always in good health and ſpirits when thus fed. Sometimes he made them into hay, managed in the ſame manner as clover or meadow graſs; all which ſhould be left in graſs cocks in the field whilſt it is haying, very ſeldom ſpreading it, for fear of rain; and after two or three turns it is generally fit to carry.

The great art of making hay of vetches, and the ſame may be applied to clover, lucerne, and other artificial graſſes, is to contrive that the leaves do not drop off the plants, which, if left too long, or dried too ſuddenly, they are apt to do;

and it is well known, that great part of the nouriſhing quality of hay reſides in the leaf and flower. Every kind of cattle are fond of theſe, and they all thrive amazingly on this food. Sometimes Mr. Smith let his crop of vetches ſtand till the pod was formed, in which ſtate he found from experience that they are the hearticſt food for horſes.

There is ſtill another method of treating a crop of vetches, mentioned by Mr. Smith; which is, to let them ſtand till the ſeed is at full ſize in the pod, though not ripe; to cut them then and threſh out the ſeed, which he ſells well in the market for pigeon's meat; and though the hay is not ſo good in this way as in the former, ſtill it ſerves well for work-horſes. When vetches are plowed in for a ground-dreſſing, this ſhould be done ſome weeks before the wheat is ſown, that they may have time to ferment and rot completely. Mr. Smith once loſt a fine field of wheat by not attending to this circumſtance.

Vetches, ſays a gentleman farmer in Surry, are a grain often overlooked by the farmer, yet are they highly valuable, and very beneficial. They are a very hardy grain, and reſiſt the ſevereſt winter, better than moſt other crops. Beſides, they have the additional advantage of growing in almoſt any ſoil: but the farmer muſt only expect a produce according to the goodneſs of his land.

Few farmers give more than one plowing for vetches, but they ſhould give two at leaſt. This gentleman thinks the firſt week in October the beſt ſeed time for vetches; and allows two buſhels to an acre, which he finds quite ſufficient. He ſows them on the rough land, after the ſecond plowing, and then harrows them in, length ways, and croſs ways; after which he paſſes a roller over the land, which if light and dry, he performs with a heavy roller; but if ſtiff and moiſt, with a light one. I am, continues this gentleman, an old man; and in the courſe of many years practice, have ſowed vetches often on a ſandy and gravelly loam, a chalk, though not for plowing in, a gravel, a low damp clay, and a perfect brown loam. On all theſe varieties of ſoils have they ſucceeded with me; but I muſt note, that the farmer may expect a larger crop from a gravel (I do not mean a pure gravel), that has ſome heart and ſtrength in it, than from the fineſt loam, which has been, by a long continued courſe of bad culture, ſtarved and impoveriſhed. The large vetch may be ſown in January, February, March, April, or even the beginning of May, when deſigned for green fodder, or for a green dreſſing; but it ſhould not be ſown before Chriſtmas; for it is a tender plant, and may be deſtroyed by hard froſt.

SECTION IV.

Of LENTILS.

LENTILS grow to the height of about a foot, or one foot and a half; with ſtalks and leaves like thoſe of tares, but ſmaller; and like them they bear their ſeeds; generally three or four in little pods. Theſe ſeeds are round, hard, ſmooth and flat, but thicker in the middle than at the ſides. Of the two ſorts, which are commonly cultivated, the white is moſt eſteemed for the food of men; but the yellow, which is the largeſt, affords the greateſt quantity of fodder. The bloſſoms of the firſt are of a purpliſh white, and thoſe of the laſt are quite white. The ervum or ſmall black lentil, is too bitter to be eaten.

Lentils do beſt in a middling ſoil. There they yield an immenſe increaſe, if too much rain does not fall while they are in bloom: but in rich land they grow too luxuriant to ſeed well. The common cuſtom in foreign countries, where they are much uſed in ſoups, &c. is to let them lie four or five days mixed with dry dung, in order to make them ſprout the ſooner, and then to ſow them with that dung (which is alſo Columella's advice), after either one or two plowings, but two are beſt; and to harrow them in lightly, for they muſt not be buried deep. Some allow even more than two buſhels to an acre of land; but one buſhel is full enough, for they branch out very much.

In hot countries, where it is common to have two crops of this grain in a year, the uſual times of ſowing it are, towards the end of October and in the month of February: but March is the moſt proper ſeaſon with us. The lentils ſowed then, will bloſſom and ripen in July and Auguſt. They are a very good ſweet fodder; perhaps the beſt of any for calves, and other young cattle; and their ſeeds are the cheapeſt of food for pigeons. Great care muſt be taken to cleanſe and dry them well in the ſun, before they are laid up, and to keep them in a very dry place; for the weevil is extremely apt to breed in them. When properly preſerved, they grow exceeding hard, and will keep a great while.

SECTION V.

Of LUPINES.

THIS plant, which is a kind of wild pea, requires the leaſt labour of any thing that is ſowed. It will thrive in any ſoil, except the chalky and miry; but delights particularly in poor, hungry, worn-out land, eſpecially if it be dry and ſandy. If ſown in February or March, after a ſingle very ſhallow plowing, and ſlightly harrowed in; or even harrowed in without any plowing, it will bloſſom three times between May and Auguſt, and prove an excellent enricher of the ground, when plowed in juſt after its ſecond blooming. In warm countries, lupines are much ſown in vineyards for this purpoſe only, and are found to be one of the beſt manures that can be laid to the roots of the vines.

Their ſeeds ripen towards the end of September, or beginning of October. They are very bitter; to remedy which, the Spaniards and Italians, who feed their cattle and horſes with them in winter, ſteep them in river water and ſalt, till that bitterneſs is gone; and afterwards dry them thoroughly over a fire, or in the ſun.

They even make bread of them when corn is very ſcarce, and put them to ſeveral other culinary uſes. The beſt time for mowing them, is after a ſhower of rain, becauſe the ſeeds drop eaſily out of their pods when gathered too dry. They muſt however, be laid up very dry, or worms will ſoon breed in them. The red and the blue lupines, which we plant in our gardens by way of ornament, grow wild, in great quantities, about Madrid.

ESSAY VI.

Of Cabbage Plants.

THE kinds of cabbages that were formerly moſt commonly cultivated in the fields, for the food of cattle, were, the large colewort, or borecole, *braſſica ſimbriata maxima*; and the perennial colewort, *braſſica arborea.* Both of which, I believe, are now very little in uſe, having been ſucceeded by other plants not only more hardy, but alſo more productive of that green vegetable food, much wanted, and ſo very neceſſary for cattle in the ſpring of the year, when the ſtock of hay and ſtraw begins to be exhauſted, and the graſs is yet unable to furniſh a ſufficient ſupply.

Hitherto, the grand reſource of the farmer in this country, has been the turnip culture, of which I ſhall ſoon have occaſion to ſpeak.

As cabbages are nouriſhed by a long tap-root, it is neceſſary that they ſhould be planted in a deep ſoil; or if it is not naturally ſo, it ſhould be deepened by plowing twice in one place, that is, by one plough following another in the ſame furrow, ſo as to turn up freſh ſoil, which ſhould be rendered mellow and mouldy, by repeated plowings, until the ſeaſon of ſowing or planting. Cabbages, like pulſe and grain, have been cultivated both in the old and the new modes of culture, and like them, have always ſucceeded beſt, where the horſe-hoe could be properly introduced to aſſiſt their vegetation. When ſown in the broad-caſt way, they have been ſet out by the hand-hoe at proper diſtances, and cleaned at proper ſeaſons, in the ſame way as turnips. But when ſown, and not tranſplanted, it is far preferable to do it by the drill in rows of four or five feet aſunder, to admit of the horſe-hoe, which is undoubtedly neceſſary to bring this plant to any degree of perfection. Even when ſowed in drills, they will require being thinned in the rows by the hand-hoe, and ſet out at the diſtance of twenty inches or two feet from plant to plant.

But though I have mentioned both theſe methods, yet I am far from recommending them; as I am ſenſible they are much inferior to that of planting them out from a ſeed bed; where they ſhould be firſt ſowed, and allowed to ſtand till of a proper age for tranſplanting.

In treating on this ſubject, I will firſt obſerve what I have learned from others, and then what I myſelf would recommend.

Scotch cabbages are thoſe which are now moſt in eſtimation for field culture. If they be the true flat-top firm kind; they are never affected by froſt, a few of the outſide leaves only excepted. But great care ſhould be taken to have the right genuine ſeed: otherwiſe it may occaſion much diſappointment. On land not worth more than twelve ſhillings per acre, fifty-four tons per acre have been raiſed*. An ox will commonly eat about two hundred pounds in twenty-four hours: twenty oxen may therefore be kept near five weeks on an acre of cabbages of that weight; but as crops in general are not ſo large, we will reckon only a month; which will be cheaper than a ſcore of oxen can be kept on any other food.

A ſheep of twenty pounds per quarter, will eat fifteen pounds of Scotch cabbages in twenty-four hours. An acre will therefore maintain two hundred ſheep a full month. When cows and oxen are fed with cabbages, their dung is more in proportion than when fed with turnips, which go off more in urine; or with hay, which is of too dry a ſubſtance. If the cabbages are planted in rows, three feet apart, the intervals may eaſily be kept free from weeds, by the horſe-hoe; and the roots of the plants will receive much benefit from the ground being thus looſened about them. Cabbages being an ameliorating crop, do not impoveriſh the land like grain.

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* Bath Soc. Tranſ. Vol. II. p. 103.

Mr. Ilbert of Devon ſays, that he had an acre of land planted with the green Scotch cabbage, in rows four feet apart, and the cabbages at three feet diſtance in the rows. The ſoil was a reddiſh loam, worth about twenty ſhillings per acre: a bean ſtubble was firſt plowed in December, and afterwards in May, and had a ſmall quantity of dung; horſe-hoed three times. On the ſeventh of June the plants were ſet out from the ſeed-bed; and on the twentieth of December they were ſaid to weigh eighty thouſand one hundred and ſixty pounds, that is thirty-five tons. Till within theſe five years, this vegetable was unknown in the ſouthern part of Devon; but is now adopted by the beſt farmers, on account of its great utility.*

The above obſervations by correſpondents of the Bath and London Societies, are well worth attending to; and ought to convince every huſbandman of the vaſt utility of cabbages; ſince there is not, perhaps, any one eſculent plant that grows, which will produce near ſo great a quantity of green food for cattle; eſpecially conſidereing, that the land which produced this immenſe load, is only valued at twelve ſhillings, and at twenty ſhillings per acre.

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* Lond. Soc. Tranſ. Vol. II. p. 72.

But the plant which ſeems to gain the preference above all others, and of which the culture ſpreads moſt rapidly all over this iſland, is the turnip-rooted cabbage. A plant whoſe principal utility certainly lies in the root; and therefore it might with more propriety be claſſed with that ſpecies of plants; but as, from its name, it has always been ranked amongſt the cabbage kind, I have alſo placed it there.

Mr. Lewen Tugwell, a correſpondent of the London Society, informs us*, that the field he firſt planted cabbages in was a good ſandy loam; but was at that time exceedingly impoveriſhed, and in a moſt filthy condition. It had received two fallowings, cutting each other tranſverſely, by which it was thrown into clods of about nine inches ſquare, and theſe ſo matted with roots of couch-graſs, that they could not be reduced. However, having taken every method of tumbling theſe clods about in an aukward manner, he at Midſummer gave the field a dreſſing of about twelve cart loads of dung to an acre, and plowed it into one-bout ridges, and in the middle of each covered up the dung. On each ridge, at two feet diſtance, he ſet out a row of plants from the ſeed-bed, which had been ſown about eight weeks before. When he thought them ſufficiently rooted, he gave them a hand-hoeing, to which ſoon ſucceeded a horſe-hoeing, by the common ſwing-plough, fetching on either ſide a furrow from each row, and throwing it into the middle of the intervals; and this being in due time returned back to the plants, the cultivation was completed. After this, they began to flouriſh ſurpriſingly, threw out an amazing luxuriance of their foliage, and at intervals continued growing throughout the following winter.

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* Lond. Soc. Tranſ. Vol. I. p. 138.

Towards the middle of April, when the common turnips, rape, &c. were all conſumed, and many of the neighbours' flocks in the greateſt diſtreſs, he turned in his tegs (one year old ſheep) ewes, lambs, &c. to the amount of four hundred; and had every reaſon to be pleaſed with the effect; refuſing hay, they fed wholly on turnip-cabbages, and having continued between five and ſix weeks, went off greatly improved.

Some time after the firſt had been introduced, three hundred tegs more, the property of a neighbour, were brought on, from the ſingular ſeverity of the ſeaſon in a very ſtarving condition. Theſe remained not quite a fortnight, and without any aſſiſtance from hay, went off very much amended.

About the 18th of May, he turned all to their paſture, and hauled great quantities of the roots, in high perfection, to adjoining avenues, for manure, and at a very late ſeaſon ſowed the field with barley; and notwithſtanding the inclemency of the weather, during the ſummer, he had from this eaſy eligible mode of cultivation, a return of almoſt three harveſt-loads from an acre, throughout the field.

As the number of ſheep has been always governed by what could be ſupported during the ordinary exigencies of the ſpring, it is more than probable, that by the general culture of this plant, the flocks may be greatly increaſed, and the arable land proportionably benefited thereby.

In a ſecond letter from Mr. Tugwell, he farther adds, that in the courſe of his next year's experiment, he found he was vaſtly deceived in his ſeed; and therefore recommends it to every one, to raiſe it for themſelves, rather than truſt to what is bought. He alſo mentions as an improvement, to give the ewes and lambs, while kept on the turnip-cabbages, a run in an adjoining graſs field; by which the lambs in particular do much better than when confined to the turnip-field ſolely. The juices of the plant are certainly rich, for they are very fattening; but being of a ſolid ſubſtance, do not ſupply the milk of the ewes in ſuch quantities, and ſo frequently, as is neceſſary.

Intending the field for barley, he could not wait longer than the 18th of May, when he had a great many of the roots hauled to the aforeſaid graſs field, where the tegs paſturing, continued at intervals to feed on them till Midſummer; and it was obſerved by the neighbours, that although they enjoyed their fill of fine graſs, they were ſeldom known to lie down any where but among the turnips, while any remained. This may be conſidered as a preference given by the ſheep to this excellent root: and with reſpect to its effects, Mr. Tugwell declares, he never experienced any plant ſo fattening, or that kept the ſheep in ſuch perfect health.

The management of this year's plantation was exactly the ſame as the laſt; and the field being thus prepared by the ſeveral hoeings, and the dreſſing by the fold, it was left in admirable condition, and about the 18th of May was ſowed with barley, and brought a rich and luxuriant crop, in quality remarkably fine.

Let me here obſerve, that on ſuch an occaſion as this, the Siberian barley, which ripens ſo early, might be of real utility.

The expence of a crop of turnip-cabbages (horſe-hoeing only excepted), varies but little from that uſually attending a crop of common turnips; and when we conſider its ſuperior quality, the greater certainty of the crop, not ſubject to the fly, its hardineſs alſo in reſiſting every degree of froſt, and the great benefit the ſoil derives from its cultivation, it is very apparent, that this plant, in point of value, ſtands little or nothing behind its kindred ſpecies. Mr. Tugwell adds another curious obſervation; that when ſheep are fed on theſe turnip-cabbages, they have always rejected hay, which is not the caſe when they are fed on the common kind of turnips.

As Mr. Tugwell has here taken particular notice of the improvement of the ſoil, by the culture of this plant, I muſt obſerve, that every cultivator is not convinced of its being attended with this good effect. Mr. Boote, particularly, informed me, that he has from experience always found it a very exhauſting crop; and thought it neceſſary in his courſe to give his land an ameliorating crop after it, before he could venture to ſow any grain.

Mr. Robbins, a neighbour of Mr. Tugwell, cultivated this plant on eleven acres of an extremely light, ſtony ſoil, by which he was enabled to ſuſtain and preſerve through the difficult ſeaſon, two hundred and ten ewes, with two hundred and twenty lambs, in the moſt deſireable manner, for a month. And alſo, with the refuſe, or bottoms, ſuch as the ewes and lambs left, he kept one hundred and eighty tegs, during the ſpace of ſix weeks. He gave the ewes no hay, but let them and the lambs have a backward run, on a ſmall adjoining field of rye-graſs; for he had obſerved, that although the ewes increaſed in fleſh, the lambs fell rather behind, which made both him and Mr. Tugwell think that this plant tended rather to fatten, than to ſupply milk: the quantity of rye-graſs was very trifling, but had a very deſireable effect; for the lambs were obſerved to recover upon it immediately.

Mr. Robbins's mode of management was ſomewhat different from Mr. Tugwell's, above deſcribed. Previous to his ſetting out the plants, his field had, the ſame ſeaſon, been under vetches, which were ſoiled, or fed off with ſheep: he then plowed it, gave it ſome dung, and put the land into its proper form for planting. At Midſummer the plants were ſet out at eighteen inches diſtance in the rows, and then about thirty-ſix inches apart. When the weeds began to ſpring, he had them hand-hoed. Some time after, a ridge was thrown up in the intervals by a plough; which after remaining as long as was neceſſary, was thrown back again to the plants. He again, at ſome diſtance of time, gave them another hand-hoeing, by which means the land was brought into the fineſt tilth imaginable, and the plants had all the requiſite aſſiſtance.

Intending to ſow the land with barley, Mr. Robbins was under the neceſſity to haul off ſeveral loads of the roots; and although barley was not ſown till the 14th of May, and the ſeaſon proved remarkably dry, yet he reaped near three loads an acre; which extraordinary produce he imputed to the ſuperior mode of cultivation, and ſhould always be a ſtrong inducement to propagate this moſt valuable vegetable.

Mr. Tugwell, in anſwer to queries ſent him by the Society in the Adelphi, gives the following illuſtrations.

His turnip-cabbage ſeeds were not ſown in the ſeed-bed till the 9th of May; whereas in that part of the country (Glouceſterſhire) he is of opinion they ſhould always be ſown before the middle of April. As the earth of the ſeed bed ſhould be good, and as free from weeds as poſſible, he has choſen to ſow his ſeeds in a garden, and found them always come forward ſufficiently ſoon for his purpoſe.

Some of his neighbours followed another courſe, which has anſwered well. This was, throwing off the mulch with an inch or two of the ſurface mould, from the winter ſheep-fold, in a warm corner, in or contiguous to the field to be planted. The under mould is then moved with the ſpade, or plough, three or four inches deep; and the ſeed being ſown, the plants ſoon make their appearance, and grow away ſurpriſingly.

If, by prudent foreſight, care has been previouſly taken to convey to the aforeſaid ſheep-fold, ſtraw, ſtubble, fern, or whatever may be attainable, ſufficient and proper for making a compoſt for the whole plantation; there will not only be found a great ſaving in the moſt expenſive part of manuring, the carriage, but much more will alſo be executed in a given time, by the materials lying near; a circumſtance of great importance in huſbandry, in which time is ſo valuable.

Mr. Tugwell adds, that there is another advantage from the ſeed-bed being in or near the field, where the plants are to grow, that they will be leſs time out of the ground. With regard to the fly, though this plant is much leſs liable to its depredations than the common turnip, or other cabbage plants, yet on all ſuch occaſions, when wood aſhes can be obtained, they are always found to be a preventive, by ſcattering them lightly over the plants, in the dew of the morning.

Some have dipped the roots of the ſeedling plants in mud, or a mixture of earth and water, to preſerve them moiſt, till planted; but they are hardy, and do not require this. The earth ſhould be well cloſed round them, when planted. When firſt put in the ground, it is neceſſary to guard them from the rooks and crows for ſome days, till they take root. They ſhould be drilled extraordinary thin in the ſeed bed, to prevent their being drawn up too long ſtalked; by which they loſe their natural ſhape, which they never regain.

Mr. Tugwell's crop was planted out on the ridges, three weeks after Midſummer. He has a neighbour who planted his crop, ſome weeks before Midſummer. Mr. Tugwell's crop was not near ſo good as his neighbour's, nor his plants ſo heavy. He ſeems therefore to think, that the plants ſhould be ſet out and growing by Midſummer.

The average weight of his laſt year's crop was three pounds each; ſome few amounted to ſix or ſeven, and even eight pounds each, and thoſe planted ſooneſt were the largeſt.

The ewes and lambs were turned in upon them the 9th of April, and drawn off the 2d of May. The tegs were turned in the 13th of April and taken away the 18th of May. Young lambs, confined within hurdles on an arable field, ſeldom do well. The moſt eligible way would be to haul the roots, ſome time in April, intirely off the field where they grow, and throw them about, on ſome adjoining paſture, or field of rye-graſs, clover, &c. to be ſowed with wheat the enſuing ſeaſon; and the ſheep may be folded on this, the ſame as on the arable, to ſpread the dreſſing equally. Mr. Tugwell is of opinion, that this would be an advantage to the roots, as it would prevent them from throwing off their juices into leaves and branches; and the land on which they grew, might be plowed and ſowed with barley in proper time, which otherwiſe comes to be too late.

Mr. Robbins, who I have juſt now quoted, gives the following information in a ſubſequent letter to the London Society.* Laſt ſpring, fodder was ſo ſcarce, and the turnips all eat up, that he determined to try the experiment, how many ſheep could be kept on an acre of turnip-cabbages, for a given time; he accordingly ſhut up two hundred ewes with their lambs in a poor piece of land of about ten acres, and fed them regularly, after pulling up the roots and cleanſing them from leaves, dirt, &c. and found that one ton was ſufficient to ſerve them a day, and to keep them in all deſireable health. He then gave them one piece more of land to run over, ſown with rye-graſs the preceeding year; and though the feed was trifling from being eaten all the winter, and late in ſpring; yet by the help of that only, thirteen tons ſerved them eighteen days; at the end of which time, both ewes and lambs were much improved: which is more than four acres of common turnips would have done in April, the time thoſe were fed. The ſoil was a ſtone braiſh, inclining to ſand, worth about ten ſhillings per acre. The preparation, the ſame as for turnips, a winter and ſummer fallow; three times plowed; about twenty put (cart) loads of compoſt per acre of earth and dung properly mixed the preceeding winter. As this compoſt anſwers better than dung alone, a ſufficient quantity ſhould always be provided.

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* Lond. Soc. Tranſ. Vol. IV. p. 19.

About the beginning of April, the ſeed is ſowed in a clear ſpot of ground, generally upon an old paſture, where the ſheep-fold has been in winter, after taking away the dung, and taking care to dig it very ſhallow, ſo as the roots of the young plants may ſoon reach the dung or ſalts; which muſt of courſe be left, in order to force them out of the flies way, as thoſe inſects are amazingly fond of them; more if poſſible than of turnips. About the middle of June is the proper time of planting them, if the weather anſwers, in one-bout ridges, raiſed by a double plough, made for that purpoſe. Seven hundred plants are enough for one acre; if ſix only, their roots will be the larger. As ſoon as the weeds riſe, they muſt have a hand hoeing; after that, a furrow is plowed from each ridge, which, after lodging a proper time, is thrown back upon the plants by the double mould boarded plough; and this is all that is neceſſary for their cultivation. The produce of one acre, with Mr. Robbins, was thirteen tons, ten hundred weight, and ſeventy-ſix pounds. This is not a third of the weight of Scotch cabbages raiſed on an acre; but perhaps, this is a more uſeful and hardy vegetable: of which however, it would be right to have comparative experiments.

Mr. Small, a member of the ſociety in London, communicated a letter from Mr. Roſs, profeſſor of church hiſtory, in the college of Aberdeen; in which Mr. Roſs informs him, that they had made trial of the turnip-cabbage at Cullen-houſe, a ſeat of the earl of Findlater in Banſhire, in the north of Scotland; and that they had ſucceeded beyond expectation.

Mr. Roſs farther ſays, that the ſeeds were ſowed about the middle of March, 1784, in garden ground properly prepared, and the plants were fit for ſetting out, by the middle of June; when they were tranſplanted into a light dry ſoil, well cleaned, and dunged with rotten cow dung; in rows three feet diſtance, and twenty inches diſtance in the rows.

They were kept very clean, and the earth was hoed up to the roots of the plants, which perhaps prevents the rind of the roots from becoming ſo hard as otherwiſe it might have been. After all, it was neceſſary to cut the roots in two, before the ſheep could eat them: when they were cut, they eat them greedily, preferring them to every other food; and the roots continued perfectly ſound and good, at leaſt a month after the common turnips became unfit for uſe. The roots, in general weighed from eight to ten pounds; a few of them more*.

This laſt obſervation of Mr. Roſs's, is ſomewhat ſingular, ſince Mr. Tugwell makes the average weight of his roots only three pounds; and if thoſe mentioned by Mr. Roſs were weighed with the Scotch pound, which is conſiderably heavier than the Engliſh, the difference of the two crops muſt have been ſtill greater.

In a ſubſequent letter from the ſame gentleman to Mr. More, ſecretary to the Society of Arts†, &c. he there informs him, that this plant ſucceeds extremely well in the northern counties of Scotland, and that there is the greateſt probability of their becoming a very valuable acquiſition to the farmers in thoſe parts, as a ſpring food for cattle and ſheep, after the turnips are conſumed, and become unfit for uſe.

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* Lond. Soc. Tranſ. Vol. IV. p. 24.

† Lond. Soc. Tranſ. Vol. VI. p. 69.

Mr. Roſs adds, that the trouble and expence of raiſing theſe plants in a ſeed-bed, and of tranſplanting them afterwards, had diſcouraged many farmers from attempting to raiſe them in large quantities: to obviate which, it had been tried to ſow them broad-caſt about the beginning of June, in a field properly prepared for turnips; and the crop ſown in that manner, and managed in the ſame way with the turnips, was fully equal to that raiſed from plants ſown in a ſeed-bed in April, and tranſplanted about Midſummer.

This experiment Mr. Roſs was going to have communicated to the Society much ſooner, had he not accidentally ſeen in the third volume of the Bath Society's Tranſactions, a letter of Sir Thomas Beevor, giving an account of his ſucceſs in raiſing them, in the ſame manner, for ſeveral years paſt. A trial was then made in that part of the country to raiſe them according to Sir Thomas's directions, and they ſucceeded admirably.

Another trial was made by drilling the ſeed in the middle of May, in ground properly prepared. The crop was fine, and the cabbages grew to a great ſize; but a large proportion of them ran to ſeed, in the months of October and November, which convinced Mr. Roſs that they were ſown at too early a period, and that the moſt proper ſeaſon for ſowing them in that part of the country is, from the firſt to the middle of June.

Mr. Roſs having mentioned Sir Thomas Beevor's letter to the Bath Society, I am ſure I cannot lay better information before my reader, than by giving the ſubſtance of that letter.

Sir Thomas ſays, he has long experienced the great benefit of the turnip-rooted cabbage, as a late ſpring feed; and that in the year 1783, which was ſo unfavorable to the crops of common turnips, by the mildew in autumn, and the ſevere froſt of winter, whereby they became rotten ſoon after Chriſtmas, his neighbours began to ſee the propriety of a practice they had ſo long overlooked and neglected; that is, their having part of their turnip-crop of this kind, as Sir Thomas always had.

He is convinced that the following is the beſt method of cultivating them.

In the firſt or ſecond week of June, he ſows in broad-caſt the ſame quantity of ſeed as of turnips, hoes the plants at the ſame ſize, and treats them in every reſpect like a turnip-crop. In this way, he has always obtained a plentiful crop; to aſcertain the value of which, he ſays, that on the 23d of April, having then two acres left, ſound and in great perfection, he divided them by hurdles into three parts, of nearly equal dimenſions. Into the firſt part he put twenty-four ſmall bullocks, of about thirty ſtone weight each (fourteen pounds to the ſtone), and thirty middle-ſized fat wethers, which, after they had eaten down the greater part of the leaves, and ſome part of the roots, were ſhifted into the ſecond diviſion, and ſeventy lean ſheep were put into what was left of the firſt; theſe fed off the remainder of the roots left by the laſt ſtock; and thus they were ſhifted through the three diviſions, the lean ſtock following the fat, as they wanted food, until the whole was conſumed.

The twenty-four bullocks, and thirty fat wethers, continued in the incloſures until the 21ſt of May, being exactly four weeks; and the ſeventy lean ſheep until the 29th, which is one day over four weeks: the value, at the rate of keeping at that ſeaſon, cannot be eſtimated, in any common year, at leſs than four pence a week for each ſheep, and one ſhilling and ſixpence a week for each bullock, which together amounts to fourteen pounds, ten ſhillings, and eight pence for the two acres.

The price of keeping the ſtock is ſurely not put too high; it is beneath the Norfolk price almoſt every ſpring; and in the ſpring of 1784 it was worth double, could it have been procured, which was not the caſe, ſo that hundreds of ſheep and lambs in that county were loſt, and the reſt greatly pinched for want of food.

Sir Thomas has made no claim for an advantage which ſurely ariſes to the farmer, by being enabled to ſuffer his graſs to get into a forward growth, nor for the ſuperior quality of theſe turnip-cabbages in fattening his ſtock; both of which circumſtances give them an additional value. But as this continuance on the land may ſeem to be injurious to the ſucceeding crop, and indeed will totally deprive the farmer either of oats or barley; ſo to remedy that inconvenience, he always ſowed buck-wheat on the firſt earth of the land from which the turnips were thus fed off. He allowed one buſhel of ſeed per acre, and commonly reaped from five to ſix quarters in return; and that he might not throw that part of the land out of the ſame courſe of tillage with the reſt, he ſows clover or other graſs ſeeds with the buck-wheat, in the ſame manner as with oats and barley; and he always found as good a plant of it afterwards.

Thus, in providing a moſt incomparable vegetable food for cattle, in that ſeaſon of the year in which the farmer is generally moſt diſtreſſed, a conſiderable profit may likewiſe be obtained by the great produce and price of a crop raiſed at ſo eaſy an expence as that of buck-wheat, which ſells commonly at the ſame price as barley, and often at more. Sir Thomas is of opinion, that no farmer will ever have cauſe to regret adopting the practice here recommended, for it will ever be found convenient and profitable, though in many inſtances, not perhaps to the degree he has ſtated. The land on which he uſually ſowed his turnip-rooted cabbages, was a dry ſoil, worth about fifteen ſhillings per acre.

It is almoſt unneceſſary for me to remark, that the whole of this information is extremely intereſting, and well worth the ſtricteſt attention of the judicious farmer.

With reſpect to cabbage plants, I have yet to mention ſome part of Mr. Baker's reports to the Dublin Society, in which he gives the reſult of ſeveral intereſting experiments made in Ireland, together with many curious obſervations on this ſubject.

It is obvious, that in cultivating of cabbages, the objects principally in view are, the quantity of food they produce, and the ſeaſon in which they produce it. With regard to the former, I have already ſhewn, from good authority, that they will, if well cultivated, bring from twenty to thirty, or forty, or fifty tons, nay, even more per acre. Black cattle and ſheep are remarkably fond of all ſorts of cabbages; they are completely fattened upon them, and their fleſh is well taſted: and they are alſo very ſerviceable in feeding of horſes and hogs, as we ſhall ſee preſently.

Cows fed on them give a great deal of milk, and the butter made from it is excellent. It was indeed thought otherwiſe for ſome time; but it was afterwards diſcovered, that the bad taſte of the butter, was owing wholly to the decayed leaves; for when thoſe leaves are taken off, and the ſound part only given, the milk and butter is perfectly ſweet.

Mr. Baker diſtinguiſhes between what he calls winter and ſummer-cabbages. Not that there is any difference in the kinds, but in the ſeaſons in which they are ſowed and planted. Thus, thoſe which are ſowed in the ſeed-bed in Auguſt, and planted out in the March following, are called winter-cabbages: and thoſe which are ſowed in the ſeed-bed in April, and are planted out in June, are called ſummer-cabbages.

Having already mentioned the culture of cabbages, with the proper manner of raiſing them in ſeed-beds, planting them out, and the neceſſary horſe-hoeings; I will not repeat Mr. Baker's directions, but ſhall only give from him, the following account of their produce.

Produce of Five Kinds of Cabbages, from each Ridge of Six Hundred and Thirty Feet long, and Five Feet wide; with their average, and extraordinary Weight; all being Winter-Plants.

	Diſt. in the rows.	Weight per ridge.			Average Weight.		Extra Weih t.	Prod. per Eng. Acre			Duration.
		C.	qr.	lb.	lb.	oz.	lb.	T.	C.	qrs.	
1. Green Borecole	18 in.							ran to ſeed			
2. Long ſidep	24	33	3	27	12	$1\frac{1}{4}$	16	23	15	1	To Oct. and Nov.
3. Flat Dutch	24	34	1	22	12	$1\frac{1}{4}$	20	24	1	2	To Dec. and Jan.
4. Scotch	24	34	0	11	12	2	$19\frac{1}{2}$	23	17	3	
5. Anjou Colewort	48	33	2	20	17	0	24	16	7	0	To mid. of May.
Ditto 3 feet diſt.	36	30	3	21	$16\frac{1}{2}$	0		20	8	0	

It is remarkable, that by comparing theſe experiments of Mr. Baker, with thoſe related by Mr. Young in his Britiſh Tour, that cabbages of the ſame kinds, decay earlier in the ſeaſon in Ireland than they do in England. The great Scotch cabbage in particular, with Mr. Baker, continued ſound only to January; whereas, by Mr. Young's information, from ſeveral gentlemen, it continued ſound in this country through March, April, and even till the beginning of May.

Mr. Baker very properly aſcribes it to the wetneſs of the ſeaſons in Ireland, in the months of October, November, and December; while ours are more dry and froſty.

Among the five kinds of cabbages tried by Mr. Baker, is the Anjou cabbage, or colewort, as he calls it; perhaps becauſe it ſpreads its leaves, and does not properly cabbage. The ſeed of this plant was ſent by the Marquis of Turbilly, ſo frequently, and ſo deſervedly quoted in this work, to the London Society of Arts, &c. who diſtributed it to many of the members, by which means it was raiſed in ſeveral parts of England, but without ſucceſs; ſince Mr. Young in his fourth volume, page 202, ſays, Anjou is good for nothing with Mr. Turner and Mr. Scroop. This ſentence, we ought not, however, to look upon as deciſive, when we find it doing ſo well under the management of Mr. Baker, who ſeems to think favourably of it, and has given us its produce; which is very conſiderable.

He informs us, that having turned ſome horſes into a field, where theſe plants were growing, they eat them with ſurpriſing avidity, preferring them to good graſs, and other cabbages that grew in the ſame field. They were afterwards eaten off by ſheep; and Mr. Baker computes moderately, that theſe cabbages brought ſix pounds five ſhillings and three-pence per acre. A produce, ſays he, by no means contemptible, when we conſider the cheapneſs of the culture; which, after the ground has been properly manured for potatoes, cannot amount to forty ſhillings, including rent. But let no man, adds Mr. Baker, imagine, he can cultivate this, or any other of the cabbage tribe, without liberal manuring: the moſt proper method of doing which is, certainly, by making potatoes the crop in preparation. Mr. Baker draws the following concluſions, from his own experiments, viz.

Firſt, that horſes are fond of this plant, and thrive on it:

Secondly, that ſheep are fond of it to exceſs, and fatten very faſt on it:

Thirdly, that it affords them fine ſhelter, and food free from dirt :

Fourthly, That this plant may be repeated, in the ſame land, three years ſucceſſively :

Fifthly, that alleys four feet wide, are ſufficient diſtances, and that his third crop was a noble one :

Sixthly, that theſe coleworts will pay three-pence halfpenny a head per week, for paſturing ſheep.

Mr. Baker farther obſerves, that it was a moſt beautiful ſight to ſee the white ſheep, diſperſed among theſe lofty greens, which grew with him ſix and eight feet high : the ſheep eating to about four feet from the ground, and the horſes feeding on the upper part. When the ſheep had filled themſelves, they went upon the graſs, where they lay to reſt ; then roſe, and ſtretching themſelves, returned to the cabbages. After a time, they reſted half the day ; which is a ſtrong indication of their fattening faſt. He accounts for their not having ſucceeded in the trials made here, thus ; he ſays, they have been ſown in the ſpring, and ſet out in June ; whereas, they ſhould be ſown in Auguſt, and ſet out in March. This experiment is eaſily made, and is worth the attention of farmers.

Mr. Baker ſays, that the beſt way is to ſow the ſeed in drills, and that where handy and active men are employed, three men will with eaſe tranſ-plant an Iriſh acre a day; which is about an acre and a half Engliſh.

An Account of the Experiments in the Cabbage Huſbandry, upon the Spring or Summer-Culture.

	Diſtance.		Average.		Extra.		Prod. per Iriſh Acre			Prod. per Eng. Acre		
	In.	Ft.	lb.	oz.	lb.	oz.	T.	C.	qr.	T.	C.	qr.
1. Green Borecole	21 by	5	5	6	8	0	19	4	0	12	0	0
2. Great Scot. Cab.	23 --	5	6	13	9	0	21	16	3	13	12	2
3. Anjou Colewort	2 ft.	5	5	9			17	15	2	11	2	2
4. Chos du Milan	2 ft.	5	4	8			14	8	2	9	0	0
5. Turnip Cabbage	18 in.	5	5	0			21	0	0	13	2	2
6. Jeruſ. Colewort	2 ft. 2 ft.	3 5	7	0	14	8	36 22	15 1	0 0	22 13	10 6	0 0
7. Red pickle Cab.	2 ft.	5	6	0	9	0	19	7	0	12	1	3

The ſeeds of theſe were ſown the 10th of March, except number 6, ſown the 24th of March. The land for theſe plants was plowed in November, again in April, and harrowed down; and the latter end of May it was thrown into five-feet ridges, at three bouts of the plough. The 17th of June, the land was manured, by laying the manure upon every ſecond ridge alternately, and throwing it equally into the two contiguous furrows, and immediately plowed in, by turning the ridges into the furrows; by which means, the new ridges ſtood over the dung as in a hot-bed.

Mr. Baker continues to obſerve, that with him, the only cabbage plants which have ſtood the winter well, were the borecole, the Anjou cole-wort, the turnip cabbage, and the red cabbage: theſe ſtand till ſpring, and caſt their leaves of the ſummer growth, which are ſucceeded by others infinitely more numerous, though not ſo large. Mr. Baker loſt theſe fine leaves that dropped, but thinks they may be turned to good account by letting in the ſheep, to feed upon the plants in December and January. This manner of uſing them is mentioned by Mr. Baker, to avoid the expence of pulling and bringing them home; which muſt be all men's labour, and even their carriage to the head-lands, before they could be put in carts.

Mr. Baker has attributed the want of ſucceſs in the culture of the Anjou cabbages, in this country, to their being ſowed in the ſpring, and planted out in June. This mode he condemns; alledging, that in order to inſure ſucceſs, they ſhould be ſowed in Auguſt, and ſet out in the March following. In this, however, he differs intirely from the directions of the Marquis of Turbilly, by whom they were firſt introduced into this country, in the manner mentioned above. The Marquis ſays, they ſhould be ſown in good mould in the kitchen garden, in the month of June; and ſhould be watered in caſe of great drought. They will riſe pretty ſpeedily, and ſhould be thinned wherever they ſtand too thick. They ſhould alſo be kept free from weeds, and at All-ſaints, (1ſt of November) ſhould be tranſplanted into the field where they are to remain. They muſt be planted pretty deep, that is, buried up to the leaves; the diſtance between them, two feet, or two feet and a half every way. Particular care ſhould be taken, not to plant them with a dibble, as other cabbages are planted; but to open a trench, and ſpread a layer of dung along the bottom of it, with which the roots of the cabbages ſhould be covered. The mould from the trench ſhould then be returned back upon the dung, and what remains after filling the trench, will lie between the rows of cabbages.

Towards the middle of the month of May, the ground ſhould be well ſtirred, with a ſpade, or hand-hoe, between the plants, and its ſurface made level. After this, nothing remains to be done, but weeding from time to time.

In the month of June, ſuch of theſe cabbages as are already large, and do not turn in their leaves for cabbaging, but ſtill continue green, begin to be fit for uſe, and ſoon arrive at their greateſt perfection; which they retain till next ſpring, when they begin to run up, and afterwards bloſſom. Their ſeed ripens towards the beginning of July, and thoſe for ſowing ſhould be gathered then.

In Anjou, theſe cabbages generally grow to the height of ſeven or eight feet, and ſometimes more. In the month of June, when theſe plants begin to be fit for uſe, their leaves are gathered from time to time, and they ſhoot out again. They are large, excellent for ſoup, and ſo tender, that they require very little boiling; they never occaſion any flatulence, or uneaſineſs in the ſtomach; are admirable food for cattle, and greatly increaſe the milk of cows.

The ſtem of this plant, which is about the thickneſs of one's wriſt, is uſed for fuel, when dry; ſo that it is a common ſaying in Anjou, that every cabbage plant is worth two pence halfpenny per annum.

The Jeruſalem colewort ſeems, by Mr. Baker's account, to be a very productive plant: but I have no other information about it, than what is here given.

My own ſyſtem of cultivating all thoſe plants which from their great ſize require much ſpace is, to plant them out at equal diſtances from row to row, and from plant to plant. Let us ſuppoſe that a field to be planted with cabbages, or coleworts, is properly prepared for that purpoſe by two or three good and deep plowings. Let it then be drawn out into checquers of four feet ſquare, by dividing it with pretty deep furrows, and croſs furrows. At the points of interſection, let a ſpit of good mellow dung be thrown in, and the plants be ſet up to the leaves, drawing the mould round them. The alleys between the plants ſhould then be plowed, and croſs-plowed, as they might require; and by this method little hills of earth would be gradually thrown up around them, which would not only give new pabulum to theſe plants, but, by ſtirring the ground on all ſides, they would be enabled to ſend forth freſh fibres, which would greatly invigorate them, at the ſame time that it would admirably prepare the ground for the enſuing crop, and clear it perfectly from every weed. This is what I mentioned for the culture of maize, and what I ſhall have farther occaſion to recommend for the culture of other plants.

Cole, or rape, which is the *napus ſylveſtris*, or wild navew, being a plant of the cabbage kind, I ſhall here give an account of, before I quit this ſubject. It is much cultivated in the Iſle of Ely, and ſome other parts of England, for its ſeed, from which the rape-oil is drawn; and it has alſo been very advantageouſly cultivated in ſome places, for feeding of cattle. But it muſt be obſerved, that it is of late become much leſs uſeful for this purpoſe, from the preference given to the other plants, of which I have now been treating. However, as there are occaſions when it may be found of ſervice for this purpoſe, as well as for its ſeed, I think it neceſſary and uſeful to mention its proper culture. It ſhould be ſown about the middle of June, on ground prepared as for turnips; that is, in very fine tilth: the quantity of ſeeds, from ſix to eight pounds per acre. When the plants are too thick, they ſhould be thinned by hoeing, and ſet out at a proper diſtance from each other, in the ſame way as is practiſed in the culture of turnips; excepting only, that the diſtance need not here be ſo great from plant to plant; for, as they have fibrous roots, and ſlender ſtalks, they do not require ſo much room. A ſecond hoeing, well performed in dry weather, about five or ſix weeks after the firſt, will be all the culture theſe plants will require. They will be large enough for feeding by the middle of November, when, if there be a ſcarcity of other fodder, this may be cut: but if there be not an immediate want of food, it had better be kept as a reſerve for hard weather, or ſpring feed, when there may be a ſcarcity of other green food. If the heads of theſe plants are cut off, they will ſhoot again early in the ſpring, and produce a good ſecond crop in April, which may be either uſed for cattle, or let run to ſeed; as is often practiſed, when this plant is cultivated for its ſeeds. It is ſo hardy, as not to be deſtroyed by froſt; and therefore is of great ſervice in hard winters, for feeding of ewes: for when the ground is ſo hard frozen, that turnips cannot be taken up, theſe plants may be cut for a conſtant ſupply. Mr. Miller ſays, he has found in ſeveral places where he has ſowed this ſeed, that one acre of land, thus planted, will produce almoſt as much food as two acres of turnips; and this will produce late food, after the turnips are run to ſeed: and that, if it be permitted to ſtand for ſeed, one acre will produce as much as, at a moderate computation, will ſell for five pounds, clear of charges.

Partridges, pheaſants, turkies, and moſt other fowls, are ſo fond of theſe plants, that if there be any of them in the neighbourhood of the field where they are cultivated, they will flock thither, and lie conſtantly among them.

A farmer in Eſſex gives the following account of the culture of rape-ſeed, in a letter to the Bath Society*.

He ſays, it is raiſed in that county in large quantities, and to great advantage; that it will do in almoſt any ſoil, but ſucceeds beſt on thoſe that are deep, with a clayey bottom, with manure and deep plowing. The fallow is generally plowed up early in the ſpring, and let lie till the latter end of March. It is then plowed again, harrowed down, and has a coat of manure. After this is ſpread, it is croſs-plowed again in May, and got into fine tilth by the end of June.

About the 1ſt of July, or the firſt rain after that time, the ſeed is ſowed, about half a peck to an acre. The ſeed is ſcattered with three fingers, broad-caſt, and the land lightly harrowed and rolled.

In September, the plants are hoed, like turnips, and are ſet out at about a foot diſtance, and the weeds cleared out. This hoeing coſts three ſhillings per acre; but it renders the plants much ſtronger, than otherwiſe they would be, and makes them produce more ſeed.

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* Bath Soc. Tranſ. Vol. II. p. 124.

If any part of the field miſs, it is filled up with plants from the thicker part, in the end of October, or beginning of November, which anſwers much better than tranſplanting them in January; for, in the latter caſe, ſhould a ſharp froſt ſucceed, they would be moſtly killed, from not being rooted: otherwiſe, the ſevereſt froſt in this climate will not injure them.

The produce is from three to ſix quarters per acre, and the price generally from twenty to twenty-two pounds per laſt.

The plants, when young, are in great danger from ſlugs, which prey on them voraciouſly. The beſt way of preventing this is, to ſtrew over the plants a mixture of ſlacked lime, and wood aſhes; ten buſhels of lime, and fifteen of aſhes, are enough for an acre. This not only deſtroys the inſects, but promotes the growth of the crop greatly; ſo that it gets to ſtrong head before winter.

In the month of September, the plants are cut, and threſhed on a floor made in the field, and covered with a large cloth, or waggon-tilt. The ſtraw and chaff are burnt, for the ſake of the aſhes; but ſometimes, when the ſtalks are very ſtrong, they are uſed for fences in the farm-yard to protect the cattle from the cold blaſts of winter.

The idea, that rape impoveriſhes the ſoil, ſeems to be a miſtaken one; for, in Eſſex, they get good crops of wheat after it. This plant ſhould not, however, be ſown two years together on the ſame land. It always does beſt after beans, turnips, or cabbages.

Moſt of the farmers there, let the reaping, threſhing, dreſſing, and putting the ſeed up for market, together with making the floor, at ſix-pence per buſhel; and when the crop is good, the men make great wages of it.

If the ſeeds are large, black, and free from red ones, it is reckoned good. If the crop lies long before it is ſold, it ſhould be laid very dry, otherwiſe it will loſe its colour, and be much damaged.

Some farmers ſow rape-ſeed merely for the ſake of the winter-feed it affords the cattle. It is the moſt fattening of any for ſheep. They will thrive more on rape-ſeed plants in one month, than on turnips in two, if put in ſoon after Michaelmas. In this caſe, when the crop is fed off, it is plowed up early in the ſpring, and there is always a good crop of barley after it. But this method is not general, for it requires great care and pains to clear the land of the rape-ſeed plants, which would, if not deſtroyed, ſoon grow up above the barley, and injure the crop. Beſides, whenever rape-ſeed is at a tolerable price, it is not making the moſt of it, to feed it off.

The Marquis of Turbilly remarks, that, in Flanders, the ſeed is ſown and tranſplanted like cabbages. They give two plowings to the land before winter; and it is not of much conſequence, what crop the land was laſt under. In the month of May, another deep plowing is given; the land is then harrowed two or three times, and rolled, to make it fine. Towards the 18th or 20th of July, it is again plowed, harrowed and rolled, till it is reduced to a very fine tilth: the ſeed is then ſowed, being ſcattered by three fingers: and the land is again harrowed and rolled. The Marquis ſays, twenty-four pounds of ſeed will ſow three acres; and that the plants on theſe three acres will ſerve twelve.

The land intended for the cole-ſeed plants ſhould be twice plowed, as ſoon as the crop is carried off. Ten or fifteen days afterwards, it ſhould be once or twice harrowed: and towards the end of September, it ſhould have a very deep plowing. In this laſt plowing, there ſhould be an open furrow or trench, every five bouts. The field ſhould be plowed ſo as to give an eaſy deſcent to water.

The beſt and moſt promiſing plants being taken up and tied in bunches, are carried to the field into which they are to be tranſplanted. There will always remain a number of plants in the land where they were firſt ſown; theſe are generally fed off with cattle; for the farmer ſhould never let them ſtand to ripen their ſeeds, unleſs they are intended for manure for the ſucceeding crop.

The ſeaſon in Flanders for tranſplanting is, the beginning of October. The plants are placed in rows acroſs the furrows. The rows are one foot aſunder, and the plants in the rows about ſix inches diſtant. The work is performed thus. The men make the holes with a two-pronged dibble; the women and children put in the plants and ſettle the earth around them. If the land was not dunged before it was plowed, it ſhould be ſown with pigeons dung reduced to powder: this, of all manure, has the moſt immediate effect on the vegetation of this plant: thirty buſhels are enough for an acre.

When this is done, the looſe earth in the trenches or open furrows, is to be thrown with a ſhovel among the plants in the rows. Early in ſpring, a ſpit of earth out of the trenches ſhould in like manner be caſt among the plants in the rows. This ſlight aid gives freſh vigour to the crop, choaks the weeds, and keeps the ſoil looſe.

The rows of cole-ſeed form thus a number of beds; and when it thrives well, the trenches are entirely covered, and the whole reſembles a thick copſe.

The ſeed is fit to gather about the beginning of July, when it turns yellow. It is reaped like corn, and laid in pretty large gavels on the beds; where it remains three or four days; it is then carried in cloths, in order to prevent any of the ſeed from being loſt, for it is very apt to ſhed.

In one, or ſeveral parts of the field, according to its extent, and to the quantity of cole-ſeed, the crop is formed into ſeveral ſtacks.

The Flemiſh farmers never thatch their ſtacks: they know ſo well how to make them, that rain does them no damage. The cole-ſeed heats in the mow: by which means it yields more oil, than if it had not been ſtacked.

In the month of September, they make a kind of floor in the field, whereon they threſh and dreſs their cole-ſeed. If the farmer ſhould incline to threſh it, without ſtacking, it will be neceſſary to leave the gavels longer expoſed to the air. Cole-ſeed may be cut at any time of the day, provided it does not ſhed; if it does, it ſhould only be cut in the morning and evening. As a whole field does nor ripen exactly at the ſame time, it ſhould be cut in different portions; being laid in gavels or heaps, the changes of weather will not affect it. It may ſafely be ſtacked three or four hours after rain, provided it has lain ſome time previouſly in gavels, till it is judged to be ſufficiently dry. In order to clean the ſeed, parchment ſieves are uſed, if there is any wind ſtirring; but if calm, they uſe wind-fans. Cole-ſeed ſhould not ſown be on the ſame land more than once in five or ſix years.

A correſpondent of the *Muſeum Ruſticum* obſerves, with regard to this plant, that cattle muſt be fed with it cautiouſly, or it will have fatal effects: it is beſt to give them ſweet dry hay with it, at times; this corrects the ſuperabundant moiſture of the cole-ſeed plants, and ſerves to dry up the uncorrected and raw juices, that would otherwiſe mix with the maſs of the blood. Suckling ewes may feed on it heartily, with very little danger: but experience will ſoon direct the young farmer in the management of his cattle, in this reſpect.

In Eſſex, they generally reap their cole-ſeed; and as it is very apt to ſhed, they prepare frames, lined with threſhing-cloths, each drawn by one horſe, to receive the heads of the plants, as faſt as they are cut off.

When this crop is properly managed, nothing pays better.

Another correſpondent of the editors of the above work ſays, that in the fen-countries, they cultivate

tivate this plant without any muck or dung, but have recourſe to burn-baking; the method of which, I have already fully deſcribed.

When the land is burnt, and the aſhes are ſpread, it is immediately plowed; and about one half peck of ſeed is ſown to an acre. A buſh-harrow is then drawn over it, to prevent the birds from devouring the ſeeds. The ridges are plowed narrow, that the furrows may carry off the water.

Beſides the ſlug, already mentioned, the coleſeed finds an enemy in a very ſmall black fly, which attacks it as ſoon as it begins to ſprout; and as it advances, it finds other foes. The next is called the black canker, and is a ſmall worm of about a quarter of an inch long, which takes poſſeſſion when the plant is about the ſize of a ſmall cabbage plant: but windy and rainy weather help greatly to deſtroy theſe vermin. To this ſucceeds the green caterpillar, which appears about the latter end of September, and often commits great havock, till it is diſpatched by the froſty mornings.

When attacked by the black fly, above deſcribed, it is ſometimes neceſſary to ſow the land a ſecond time, as is often the caſe with turnips; but it ſhould be well harrowed firſt, to raiſe up freſh ſoil, for the new ſeeds to ſtrike in.

It is adviſed, to draw a waggon rope over the plants infected with the canker, in order to bruſh off that little inſect: but I am perſuaded a light buſh-harrowing would have a better effect; or that failing, to have recourſe to the lime and wood-aſhes before recommended, as a proper remedy againſt the ſlugs. Theſe might alſo be powerful preventives againſt the caterpillar.

The uſual time of putting ſheep upon this food is, about Michaelmas; and they are drawn off by Old Candlemas: becauſe if the land be ſtrong and good, there is a chance for the ſeed to ſtand for a crop: in which caſe, if the ſtumps and ſtalks be left high, the beſt way is to mow the field; otherwiſe the plants will receive great damage by being left ragged and torn, which lets in the wet and rots many of them; and even thoſe that do grow, have not the vigour of what have been mowed; for the former are expoſed to the ſnow and rain, while the latter are ſecured from both, and will ſupport the ſprouts that ſhoot out at the ſides, with ſtrength and vigour. Cole-ſeed, being very apt to ſhed its ſeed, ſhould not be allowed to ſtand too long before it is reaped; and therefore it is neceſſary in ſome ſeaſons to cut it in patches, as it is ripe. If it ripens unequally on the ſame ſtalk, it ſhould be cut when the firſt is ready; for what is greeniſh will ripen in ſome meaſure after it is cut; whereas by delaying, the firſt ripe will be totally loſt.

In reaping a field from north to ſouth, every two men ſhould lay in their reaps with the heads of the ſeeds to each other, but not to touch; the heads and ends of the ſtalks lying eaſt and weſt.

The diſtance of time required from reaping to threſhing depends entirely on the weather: but when the ſtalk and ſtraw are dead, and turned white, and the ſeed appears black and plump when rubbed out of the pod, and when this parts with it freely, then is the time to begin threſhing. Though the bottoms of the reaps be a little greeniſh, they muſt not be turned, for this would bruſh out a great deal from the upper ſide: and even if the weather prove wet while threſhing, it ought not to be turned, but raiſed up gently and laid in the ſtubs, where it will dry apace.

It is always threſhed in the field upon a cloth about twenty yards long and eighteen wide. If there be a good crop, and the plants yield well, the weather bright, and the ſeed threſh eaſy, thirty coombs or one hundred and twenty buſhels, may be threſhed in a day; but ſometimes no more than ten or twelve coombs.

The cakes of cole-ſeed, which remain after the oil is extracted, are exceeding good ſood for cattle, and will ſoon fatten them. They are, indeed, apt to render the fat of ſuch beaſts yellow, and rank; but this may eaſily be remedied by feeding them with dry fodder for a fortnight or three weeks before they are killed.

Mr. Donnellan, near Dublin, in a letter to Mr. Wynne Baker, has the following obſervation on cole-ſeed. His method of culture was, to ſow it in his garden in drills, in July, and to plant it out in Auguſt, when the ground was moiſt with rain, upon ridges thrown up from a good fallow. The rows were at three feet diſtance, and the plants at eight inches diſtance in the rows; which he thought too near. If a favourable ſeaſon, the plants will be about two feet high at Chriſtmas; and in March, when the ſeed-branches have ſhot, near four feet high. A middling plant, in March 1753, weighed eight pounds, and a middling one in March 1754, ten pounds. His butter, from the time the cows fed on rape, was of a rich yellow colour, and had a particular ſweetneſs; and the ewes and lambs were in fine order. It muſt be given to cows with caution, otherwiſe it will hove them like clover.

A man will plant eight yards of a ridge in ſeven minutes; and this is all that Mr. Donnellan could recollect concerning this valuable plant, which, for quality, quantity, and duration, excelled every thing that he had experienced, or obſerved.

Computing from the ſmalleſt of the plants weighed by Mr. Donnellan, his crop was ſeventy-three tons ſix hundred weight, per Engliſh acre. He does not ſay, in what manner he cultivated theſe plants; but it ſeems by the diſpoſition of his rows, and his culture of other crops, which he does mention, that theſe were horſe-hoed. This account would leave upon our minds the moſt favourable impreſſion of the ineſtimable value of cole-ſeed, if it were not immediately checked by the reſult of an experiment of Mr. Young's. In this experiment, he prepared ground in the beſt manner; the ſoil, expoſure, and every thing the ſame; and having divided it into three equal parts, he ſowed cole-ſeed broad-caſt on the firſt, on the ſecond turnips broad-caſt, and on the third cabbages, the Batterſea ſort, in rows four feet aſunder, and three feet in the rows; the plants of which had been raiſed in the garden.

June the 15th all were hand-hoed; the 27th horſe-hoed the cabbages, and hand-hoed the other two again; July 18, the ſecond horſe-hoeing; the 28th, the third; Auguſt the 4th, hand-hoed them again; the 6th, the fourth horſe-hoeing. All the three crops flouriſhed exceedingly. October 5, cut them all, and weighed them.

		T.	C.	lb.
Cole-ſeed........	per acre..........	5	0	0
Turnips..........	per ditto..........	21	18	0
Cabbages	per ditto..........	27	18	0

Mr. Young then gave this produce to cattle, and eſtimated the value of each article by the time it laſted. In this manner, he makes the value of the cole-ſeed fifteen ſhillings per acre; that of the turnips, two pounds eleven ſhillings; and that of the cabbages, ſix pounds ſeven ſhillings and ſix-pence: and having calculated the expences of culture, he found a loſs of two pounds three ſhillings and nine pence per acre on the cole-ſeed, of ten ſhillings and nine pence on the turnips; and a profit of two pounds five ſhillings per acre on the cabbages.

From this and ſome other comparative experiments which he made, Mr. Young concludes, that, though cole-ſeed is a nouriſhing and wholeſome food for cows, ſheep, and hogs; yet the quantity of its produce is ſo inconſiderable, as not to anſwer the expences of its culture. He thinks the beſt culture for it is, ſowing it broad-caſt, and hand-hoeing it like turnips; but thinks turnips much ſuperior in value of produce, as are alſo cabbages.

The prodigious difference between Mr. Donnellan's produce, and Mr. Young's, naturally leaves a doubt that one or other of theſe gentlemen muſt have fallen into ſome miſtake; and the poor produce of five tons per acre of cole-ſeed, according to Mr. Young, is the more ſurpriſing, as Mr.

Miller, whoſe authority ſurely ſtands high, has informed us, as above mentioned, that one acre of cole-ſeed will produce food for cattle equal to two of turnips. I am very ſorry that I am not qualified, from experience, to decide a queſtion of ſo much importance.

There is no doubt, that the moſt profitable application of a cole-ſeed crop is, for the ſeed; and Mr. Young ſays, that, upon inquiry, very little is now raiſed in this country for any other purpoſe. Cows, or ſheep, if turned into it, are only allowed to feed it on the footing that wheat crops are fed off by ſheep; and even when that is done, it is ſuppoſed by many farmers, that the crop of ſeed ſuffers much more thereby, than is gained by the feed.

I have already mentioned the cakes of the rape, or cole-ſeed, as excellent manure for land: but they are now ſo much uſed for the food of cattle, that they are become a very expenſive dreſſing.

END OF VOL. I.